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ABBREVIATED TITLES USED IN THE ABSTRACTS

Abbreviated Title.	*Journal.*
Aircraft Eng.	Aircraft Engineering.
Analyst	Analyst.
Ann. des Comb. Liq.	Annales de l'office National des Combustibles Liquides.
Ann. Min. Roum.	Annales des Mines de Roumanie.
A.P.I.	American Petroleum Institute.
Asphalt u. Teer	Asphalt und Teer.
Aut. Ind.	Automotive Industries.
Auto. Eng.	Automobile Engineer.
Aviation	Aviation.
Azerb. Neft. Khoz.	Azerbaldzhanskoe Neftyanoe Khozyaistvo.
Bitumen	Bitumen.
Brenn.-Chem.	Brennstoff-Chemie.
Bull. Amer. Assoc. Petr. Geol.	Bulletin of the American Association of Petroleum Geologists.
Bur. Stand. J. Res.	U.S. Bureau of Standards Journal of Research.
Bur. Mines Bull.	U.S. Bureau of Mines Bulletin.
Bur. Mines Repts. Invest.	U.S. Bureau of Mines Reports of Investigations.
Bur. Mines Tech. Paper	U.S. Bureau of Mines Technical Paper.
Canad. J. Res.	Canadian Journal of Research.
Chem. Age	Chemical Age.
Chem. Markets	Chemical Markets.
Chem. Met. Eng.	Chemical and Metallurgical Engineering.
Chem. Rev.	Chemical Reviews.
Chem. Trade J.	Chemical Trade Journal.
Chem.-Zeit.	Chemiker-Zeitung.
Chemist-Analyst	Chemist-Analyst.
Commer. Stand. Mthly.	Commercial Standards Monthly.
Compt. rend.	Comptes rendus hebdomadaires des Seances de l'Academie des Sciences.
Diesel Power	Diesel Power.
E.P.	English Patent.
Econ. Geol.	Economic Geology.
Eng. News Record	Engineering News Record.
Engineer	Engineer.
Engineering	Engineering.
Erdöl und Teer	Erdöl und Teer.
For. Petr. Techn.	Foreign Petroleum Technology.
Fuel Economist	Fuel Economist.
Gas. J.	Gas Journal.
Gas World	Gas World.
Geol. Mag.	Geological Magazine.
Geol. Surv. Canada	Geological Survey of Canada.
Giorn. Chim. Ind. Appl.	Giornale di Chimica Industriale ed Applicata.
Ind. Chem.	Industrial Chemist.
Ind. Eng. Chem.	Industrial and Engineering Chemistry.
India Rubber J.	India Rubber Journal.
Instr. World	Instrument World.
J.A.C.S.	Journal of the American Chemical Society.
J. Amer. Petr. Inst.	Journal of the American Petroleum Institute.

Abbreviated Title.	*Journal.*
J.C.S.	Journal of the Chemical Society.
J.C.S. Japan	Journal of the Chemical Society of Japan.
J. Fac. Sci. Hokkaido	Journal of the Faculty of Science, Hokkaido Imperial University, Japan.
J. Fuel Soc. Japan	Journal of the Fuel Society of Japan.
J. Inst. Fuel	Journal of the Institute of Fuel.
J.I.P.T.	Journal of the Institution of Petroleum Technologists.
J. Phys. Chem.	Journal of Physical Chemistry.
J.S.A.E.	Journal of the Society of Automotive Engineers.
J.S.C.I.	Journal of the Society of Chemical Industry.
J. Sci. Instr.	Journal of Scientific Instruments.
Mar. Eng.	Marine Engineer.
Mat. Grasses	La Matieres Grasses.
Mech. Eng.	Mechanical Engineering.
Mon. Petr. Roumain	Moniteur du Petrole Roumaine.
Nat. Petr. News	National Petroleum News.
Nature	Nature.
Neft.	Neft.
Neft. Khoz.	Neftyanoe Khozyaistvo.
N.Z. Dept. Sci. Ind. Res.	New Zealand Department of Scientific and Industrial Research.
Oil and Colour Trades J.	Oil and Colour Trades Journal.
Oil & Gas J.	Oil & Gas Journal.
Oil Bull.	Oil Bulletin.
Oil News	Oil News.
Oil Weekly	Oil Weekly.
Öl u. Kohle	Öl und Kohle.
Olii Min.	Olii Minerali.
Petr. Eng.	Petroleum Engineer.
Petr. Times.	Petroleum Times
Petr. World.	Petroleum World.
Petr. Z.	Petroleum Zeitschrift.
Rev. Comb. Liq.	Revue de Combustibles Liquides.
Rev. Petr.	La Revue Petrolifere.
Refiner	Refiner and Natural Gasoline Manufacturer.
Roads and Road Constr.	Roads and Road Construction.
Sed. Petr.	Sedimentary Petrography.
Trans. Faraday Soc.	Transactions of the Faraday Society.
Trans. Petr. Geol. Res. Inst. Leningrad	Transactions of the Petroleum Geology Research Institute, Leningrad.
U.S. Geol. Surv.	U.S. Geological Survey.
U.S.P.	United States Patent.
World Petr.	World Petroleum.
Z. für Geophysik	Zeitschrift für Geophysik.

ABSTRACTS.

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Class 100. Geographic Occurrence.

1. World Production and Consumption. V. R. Garfias and R. V. Whetsel. *Oil & Gas J.*, 8.11.34, **33** (25), 11.—Statistics are given showing the world production of petroleum and related fuels, with remarks to indicate whether an increase has resulted. L. V. W. C.

2. Alberta Oil and Gas Development—1934. W. Calder. *Oil News*, 1934, **36**, 349–352.—A summary of oil history in Alberta which shows that, apart from a few cases, all the oil and gas so far discovered in the province have been discovered by accident or casual drilling. It should be mentioned, however, that some drilling on scientific indications has been carried out, and that some undertakings there have been well advised from a geological point of view. There are few surface indications in Alberta as to oil possibilities, but large areas remain to be properly tested for oil. There appears full justification for the assumption that Alberta is underlain by many vast underground seepages, but whether these are within economical drilling depths or not is a question which can only be settled by the drilling of wells. W. W.

3. General Report of the Petroleum Commission (in France). L. Pineau, *Ann. des Comb. Liq.*, 1934, **9**, 781–875.—This Commission was established to investigate the question of organising a monopoly for the importation and refining of petroleum in France. The report comprises an analysis of the present system of imports and a study of various aspects of the monopoly question from financial, technical, economic, diplomatic, and military points of view. Proposals for direct or indirect control by the State were rejected, as also were further proposals that refining and imports respectively should be controlled by two national societies on which the State should be represented. The suggestions of the Commission are mainly concerned with the distribution, price control, protection of military supplies, and also a consideration of the effect of modern processes for producing gasoline, particularly by hydrogenation. C. C.

4. Petroleum in Germany. K. Fiege. *Kali*, 1934, **28**, 183–191, 200–204, 215–219, 228–230.—A detailed report regarding the occurrence of oil, gas, and asphalt in Germany. L. S.

5. Rumanian Oil Industry: Three Years' Progress. L. V. W. Clark. *Oil News*, 1934, **36**, 305–308.—A summary of modern conditions in the Rumanian industry in which the changes noted are all in the direction of efficiency, *e.g.* higher drilling speeds, over-ground cellars, *i.e.* the elimination of cellars by placing derricks on high concrete feet, central mud stations, casing programmes, use of the Schlumberger System of electrically surveying wells, geophysical surveys and standardization. Electrically-driven rigs are still popular, and the Hild drive is still in evidence. For steam-driven rigs the location of the well and the spacing programme determine whether the boilers shall be placed in a central station or as a nest by the side of the well. Where impossible to space efficiently or where the lease is a compact one, central stations are erected, and here, in most cases, boilers are equipped with superheaters which have thermostatic control. Boiler feed-water is receiving greater attention, and water-softening plants and chemicals for injecting with the feed-water have made their appearance. It is unusual to employ a boiler which is incapable of producing steam at 200 lb./sq. in. working pressure. With the shortage of high-pressure gas, attention is now being focussed on deep-well pumping. Strings of combination tubing have been run on occasion in an effort to keep down gas–oil ratio.

Paraffining-up of wells is generally dealt with by the injection of hot oil or gas or by the more positive method of running a scraper. The use of solvents is still only in the experimental stage, and results so far obtained are not too favourable. Extensive use is made of the gun perforator, where production has declined in the lower formations and upper sources have shown, or are expected to contain, commercial quantities of oil. W. W.

6. Petroleum Industry of Sweden. M. G. Holenberger, *Mon. Petr. Roum.*, 1934, **35**, 1439–1440.—This article is a brief survey of the economic position in Sweden, with particular reference to the petroleum industry. Statistics are given relating to population, number of vehicles, railways, mercantile marine, etc., and quantities of various petroleum products imported during 1933, together with country of origin and total imports of petroleum for the years 1929–1933, are tabulated. In 1933 a total of 789,517 tonnes of petroleum was imported, of which 327,533 tonnes was motor spirit. A tax of 0·1 couronne per 100 litres is imposed on imported motor spirit, and a consumer's tax of 0·1 couronne per 100 litres on all motor spirit. A Government order of June 1934 requires a certain amount of alcohol to be purchased from the National Monopoly as from October 1st, the amount for the last three months of the year being fixed at 3·6% of the quantity of motor spirit imported or despatched from the one refinery in Sweden. Large quantities of bisulphite-alcohol are produced in the cellulose industry in Sweden. This alcohol forms the base of a national motor spirit known as "Lattbentyl," which is composed of 24 parts of 99·5% alcohol and 75 parts of petroleum. A. O.

Class 200. Geology and Origin.

7. Origin of Bartlesville Shoestring Sands, Kansas. N. W. Bass. *Bull. Amer. Assoc. Petr. Geol.*, 1934, **18**, 1313–1345.—The Bartlesville sands are a system of elongated lenses which occur in the lower part of the Cherokee shale of Pennsylvanian age. These lenses form five definite trends: two have a N.E.–S.W. course (the main trends), two have a N.W.–S.E. course (the cross trends), and the fifth has a N.–S. course. They are known respectively as the Teeter, Sallyards, Lamont, Quincy, and Haverill trends. On account of their shape and distribution, the question of their origin is confined more or less to one of two possibilities: infilling of stream valleys or "bar" formation. The deciding factor is the shape and relative distribution of the lenses, and this indicates them to be off-shore bars bordering an embayment on the western edge of a repeatedly transgressing Cherokee sea. At one period off-shore bars corresponding to the Teeter and Quincy trends were formed. Silting up of the shallow coastal areas caused these bars to be covered, and so protected from erosion. Very slight tilting would be sufficient to move the shores of this shallow basin eastward, and after such a movement off-shore bars corresponding to the Sallyards and Lamont trends were formed. S. E. C.

8. Age of Gulf Border Salt Deposits. L. S. Brown. *Bull. Amer. Assoc. Petr. Geol.*, 1934, **18**, 1227–1296.—The marine cycle of deposition is first studied, and then the conclusions reached in that study are applied to conditions prevailing in the Gulf Coastal Plain with a view to determining the age of the salt deposits occurring there.

There are five distinct areas of known salt occurrence: the Coastal, the Texas interior, the Louisiana interior, the S.W. Texas, and the Smackover areas. These areas are separated by areas in which salt is unknown and which are referred to as the Coastal, Sabine, and Smackover barren belts. It is suggested that these barren belts are underlain by structures of pre-Comanche age, and from a consideration of the associated sediments and the transgressions of the Mesozoic sea the salt is shown to be not older than Comanche. The age of the Smackover salt is fixed by the fact that it is overlain by Lower Trinity sediments, and at the same time is not older than Comanche. The Texas interior and the Louisiana interior salt deposits are identical in age, and a section at Boggy Creek would seem to indicate that they are of Glen Rose age. The Gulf Coastal salt is considered from various points of view, stratigraphic, palæontologic, palæogeographic, etc., and these all point to its being mid to late Upper Cretaceous in age, and it is probably the equivalent of the Danian. S. E. C.

9. Osage Formations of Southern Ozark Region, Missouri, Arkansas, and Oklahoma. L. M. Cline. *Bull. Amer. Assoc. Petr. Geol.*, 1934, **18**, 1132–1159.—The formations in the southern Ozarks referred to as the "Boone chert" comprise at least five marine formations, and these can be correlated with the Osage of the Upper Mississippi Valley. The term Osage is therefore adopted for these formations by reason of priority.

The basal member, the St. Joe limestone, rests unconformably on the Chattanooga

shale, or, where that is missing, on the Ordovician or Silurian. The St. Joe limestone is typically a red crinoidal limestone, the base being marked by a thin green shale. It passes gradually into the Reeds Spring formation, an alternating sequence of dense, fine-grained limestones and cherts. These two formations are the equivalent of the Fern Glen of Missouri.

The Reeds Spring formation is followed by the Burlington, also a limestone and chert series. In S.W. Missouri the Burlington appears to be absent. In Northern Arkansas it is conformable with the Reeds Springs, whilst in Oklahoma there is apparently a slight break between the two. In S.W. Missouri, where the Burlington is absent, the Keokuk rests on the Reeds Spring. The Keokuk is very probably little represented in Oklahoma and Arkansas. The upper member of the Osage is the Warsaw formation, which is found only in S.W. Missouri.

A period of erosion commenced at the end of Osage times which has resulted in progressive truncation of Osage strata in a south-westerly direction. S. E. C.

10. Fluid Mechanics of Salt Domes. L. L. Nettleton. *Bull. Amer. Assoc. Petr. Geol.*, 1934, **18**, 1175–1204.—On the assumption that salt and the surrounding sediments will flow in a manner similar to highly viscous liquids, a theory of the formation of salt domes is elaborated and is illustrated by a number of experiments with viscous fluids. Evidence of flow in rocks is quoted.

A system where salt is covered by heavier sediments is inherently unstable if both act as fluids; any irregularity will tend to initiate flow. Such irregularity may be produced by tectonic movements. It can then be shown that an upward force will be exerted on the overburden by the salt. If the overburden gives, this pressure will be reduced, and at the same time salt will flow in from the surrounding area. The result is a "sink" around an uplifted plug of salt. The resistance offered by the overburden to dropping into this peripheral sink is a controlling factor in the growth of the salt dome. Unless the overburden has a definite strength, flow of material into the dome will be cut off before sediments above and below the salt can meet; on the other hand, the resistance of the overburden may be sufficiently great that flow of salt into the dome continues until the rocks above and below do meet.

The experimental work was divided into three sections to illustrate cases where the resistance of the overburden is: (1) high, (2) intermediate, and (3) low.

In cases where thick salt deposits occur without the formation of domes it is suggested that a minimum thickness of overburden may be necessary to make salt plastic, and also that incompetent beds should rest on the salt. S. E. C.

11. Geology and Economic Significance of the Lucien Field. B. B. Zavoico. *World Petr.*, 1934, **5**, 416–424.—In this article, the first of a series of articles on American oilfields, details of the geology, development, producing methods, etc., of the Lucien oil pool, Noble County, Oklahoma, are given. Discovered in Sept. 1932, the field is operated under a unit plan, the first important oil pool in Oklahoma to be so worked. To date production has totalled 3,226,000 brls. Bottom-hole pressures in the field averaged originally around 2200 lb.; in August last the average was 1600 lb., or a decline of 200 lb./1,000,000 brl. of oil produced. W. W.

12. Sarnosa Oil-field. R. A. Jones. *Oil Weekly*, 5.11.34, **75** (8), 55–57.—The surface rocks of the area are of Oligocene and Miocene age, the Gueydan series of tuffs, volcanic sands and conglomerates, and the Oakville sandstone. The Soledad Hills to the north-west have conglomerates of basalt pebbles and vesicular lava. Near the Sarnosa pool are four knob-like hills of chalcedony. Immediately north of the field is a knob of quartzite and indurated sandstone. Similar chalcedonic knobs occur here and there along the Reynosa escarpment in the Laredo oil district, also at Eagle Hills and the Picachos Hills. These hills are believed to result from silica-bearing waters ascending fault planes or simple cracks and fissures.

One or two wells were put down ten to twenty years ago, but the discovery well was drilled in 1932, and yielded gas from a depth of 2413 ft. More recently five gas and thirty oil-wells have been completed, some being small pumpers, others quite big producers. The pool covers about 400 acres, and is on the same trend as the South Government Wells, Government Wells, and North Government Wells pools, each of which produces from sands of Jackson age at depths of 2200–2400 ft. G. D. H.

13. Oil Possibilities of Belgium and Belgian Congo. S. J. Pirson. *Bull. Amer. Assoc. Petr. Geol.*, 1934, **18**, 1160–1174.—Three areas in Belgium may be considered: the Campine region, the Cretaceous basin of Mons, and the Foreland of the Midi fault.

In the Campine region Palæozoic, Mesozoic, and Cainozoic sediments were deposited on a Cambrian basement which dips gently towards the north until the Ruremonde graben is reached. Hercynian movements have caused folding and faulting in these rocks. It is considered that the Campine belongs to the same geologic unit as the English Midlands, and also, by comparison with North Germany, salt deposits may occur. Possible source beds are in the Carboniferous and the Mesozoic, the Hettangian being considered to be the most favourable. A few shows have been reported during drilling operations, and, farther north, a seep has long been known at Haarlem.

On the hypothesis of migration along the Midi fault it is possible that oil might be trapped in lenticular sands beneath the chalk of the Mons basin. Without such migration the basin is too small in extent for commercial deposits to be possible.

By assuming the Midi fault to be a low angle thrust, it was considered that oil might be trapped beneath it. Magnetic measurements, however, have disproved that assumption.

In the Belgian Congo also three areas may be considered: the Coastal zone, the Central basin, and the African rift valleys.

Oil seeps occur in the Coastal zone. The strata are probably Middle-Upper Cretaceous and Tertiary in age. Favourable structures are not known.

In the Central Basin sediments belonging to the Karoo system were deposited on an irregular surface of metamorphic and igneous rocks. There is a change in facies from arenaceous in the south-west to argillaceous in the north-east. In the north-east section the Luena and the Lukuga basins both contain coal, whilst the Stanleyville–Ponthierville basin contains bituminous shales which might be a source rock. Suitable structures may be caused by buried hills.

The rift valleys region is the most promising. Abundant seepages are known, and an exposed oil sand is reported. Mud volcanoes and thin salt beds also occur. It is possible that beds of the same series as those in the Stanleyville–Ponthierville basin occur at depth and form a source rock. Favourable structures are reported.

S. E. C.

14. Russian Oil in Far North-east. Anon. *Oil News*, 1934, **36**, 408.—A petroliferous area of 30 sq. km. has been discovered near the Tolba river in the region of Olekminsk. The Urals are now being developed, and Ishimbaevo exceeds expectations, several horizons having been discovered, two of which cover an area of 600 hectares.

At Baku two gushers have opened up the Over-Kirmakinsk sand, which is 45 m. thick, and at a depth of 1650–1660 m. There are signs of other productive strata, and these wells have disclosed a petroliferous area of 65 hectares. G. D. H.

15. The Grozny Overthrow. — Gubkin. *Petr. Times*, 1934, **32**, 532.—A gusher at Grozny is believed to derive oil from the sealed under limb of an over-thrust in the Sponiodontal and Tchokrak-Spiralis strata. The over-thrust is to the north, with a carriage of about 1 km., and the overturned under-limb dips at about 60–70°. Only in the western and middle parts of the old Grozny field do the Sponiodontal and Tchokrak-Spiralis beds occur at reasonably accessible depths. In the eastern section they lie at depths of 1500–2000 m., and exploitation of the over-thrust strata will require considerable skill in drilling. G. D. H.

16. Two Fluid Systems in Porous Media. The Encroachment of Water into an Oil Sand. H. Muskat. *Physics*, 1934, **5**, 250.—The problem of encroachment of water into an oil sand differs from the normal type of potential problem in that it is necessary to find the potential distribution in two regions of different "conductivities," which are separated by a surface each point of which has a velocity proportional to the vector gradient of the potential at the point. The area swept out by the moving interface assumes the "conductivity" appropriate to the encroaching side. The cases of strictly linear, radial, and spherical systems are solved in detail and discussed graphically. In treating the general problem, the difference in the two conductivities is neglected, and the problem is discussed in detail with this approximation. Analytical and graphical solutions are presented for: (1) systems with elliptical boundaries; (2) an infinite linear source driving fluid into an isolated sink; (3) the

history of a ring of fluid particles travelling from a source to a sink. The relation of the analytical results to the practical problems of encroachment is discussed.

P. D.

17. An Experimental Study of the Motion of Particles in Systems of Complex Potential Distribution. R. D. Wyckoff and H. G. Botset. *Physics*, 1934, **5**, 265.—A method is described whereby the motion of the interface between two liquids of equal viscosity and density moving through a porous medium in systems of complex pressure distribution may be obtained by the use of electrolytic models. Blotting-paper cut to a suitable shape to represent the distribution of source and sink or output well, is soaked in weak solution of potassium sulphate to which is added phenolphthalein solution. When the solution is electrolysed by applying electrodes at the points on the paper representing source and sink, the OH ions produced give a coloured area which gradually spreads towards the anode. The H ions produced would interfere with the progress of the coloured area, and arrangements are made by which they can be neutralised. From the position of the boundary of the coloured area after various intervals of time it is possible to plot the stream lines and the position of the interface separating two fluids, one of which is encroaching on the other. The experimental results are compared with the analytical results of Muskat (abstr. No. 16) and are shown to be accurate to within 95–98%. Illustrations are given of complex cases showing the application of these models to some practical problems of oil-field technology.

P. D.

Class 300. Development and Production.

18. Core Drill Completes 35 Holes in Three Months. Anon. *Petr. Eng.*, Nov. 1934, **6** (2), 165.—A record of combined fishtailing and coring with a Sullivan Core Drill has recently been reported from the Kansas field. The drill is mounted on a Ford truck and the mast will take out 20-ft. rods. The drill is capable of removing 1½-in. cores and of drilling to a depth of 1000 ft.

In the three months covered by the record 35 holes were completed in 69½ days' drilling. Total footage was 2823 ft., and of this 772 ft. were cored.

L. V. W. C.

19. Drilling against High Rock Pressures. C. E. Keep and H. L. Ward. *J. Inst. Petr. Techn.*, 1934, **20**, 990–1026.—A lecture with discussion on the methods used in drilling against the extremely high rock pressures encountered in the Khaur field, Punjab.

G. R. N.

20. Reducing Under-reamer Costs. Anon. *Petr. Eng.*, Nov. 1934, **6** (2), 162.—The observation of a few simple and practical rules relating to keeping the under-reamer body in proper operation condition will, in most instances, materially reduce under-reamer costs.

Diagrams, showing the main points of wear on the regular type and in the new type under-reamers, and an explanation of what to do to prevent breakage of cutters, are given.

L. V. W. C.

21. Anti-friction Bearings in Oil-field Equipment. O. Neumer. *Petr. Eng.*, Nov. 1934, **6** (2), 158.—Anti-friction bearings, having all the capabilities of the plain bearing and additional advantages, have overcome many problems resulting from the fact that deep well drilling apparatus was built, in many cases, with little regard to modern production methods.

Where these bearings are employed, greater loads can be carried with a reduction of as much as 25% in power formerly lost through friction.

In practically every position where bearings are necessary on the drilling rig anti-friction bearings are now being used.

L. V. W. C.

22. Stresses in Over-strained Cylinders. G. Cook. *I. Mech. E. Proc.*, 1934, **126**, 407–455.—Describes a theoretical and experimental investigation of the stress distribution across the walls of thick cylinders of mild steel when the internal pressure is such that the elastic limit of the material is exceeded and a certain amount of over-strain occurs. The main conclusions are: (1) That in the cylinders in which it was possible to produce over-strain over the whole wall thickness, the observed pressure is in close agreement with that calculated on the assumption of constant shear

stress equal to the shear stress observed during plastic yield in tension; (2) that in partly over-strained cylinders the maximum shear stress in the elastic region varies as over-strain proceeds; (3) that at the internal surface the effect of over-strain is to reduce the circumferential tensile stress, and to set up an axial compressive stress. With sufficient wall thickness all three principal stresses at the internal surface become compressive for pressures which still permit of the external portions remaining elastic. W. W.

23. Magnaflux Test for Discontinuities in Steel. A. V. de Forest. *A.P.I. Prod. Bull.* No. 213, May 1934, 37.—Briefly describes a form of test known as "Magnaflux," which has been perfected during the past few years for detecting the presence of lines of weakness due to stringers of non-metallic inclusions or to mechanical ruptures along longitudinal planes of weakness caused by forging or rolling, grinding cracks, fatigue cracks, etc. A few applications of the test are described concerning typical flaws/failures in helical springs, forgings, ball-bearing races, crankshafts, turbine blades, automobile rear axles, and boiler plates, illustrations of which form part of this article.

The discussion following the reading of the paper chiefly concerns the question of applying the test to drill pipe and sucker rods, particularly while strings of these are being run in and out of the hole, but although the method is perfectly portable, the author had not had sufficient experience in the field to enable him to throw much light on the possibilities of applying the test in these circumstances. W. W.

24. Form of Clay Suspensions Important Factor in Study of Drilling Fluids. W. K. Lewis, L. Squires, and W. I. Thompson. *Oil & Gas J.*, 25.10.34, **33** (23), 16.—The underlying assumptions in the study of clay suspensions are that the ultimate particles of these suspensions are extremely small, flat plates, the exterior surfaces of which consist predominantly of hydroxyl groups, chemically combined with the surface atoms of the particle structure. The hydroxyl groups are amphoteric, but predominantly acidic, the acid character being extremely weak. As a result, the highly polar hydroxyl groups exert strong fields of attractive force in the immediate neighbourhood of the particle surface, so that when adjacent surfaces come together they are held firmly, being thus able to build up large, stable essentially linear aggregates. Gelation is thus probable. The *p*H of the suspending medium influences to a great extent the acidic clay surface.

The hydrogens of the hydroxyl group can be replaced by metals. The monovalent metal salts of the clay acids are highly dissociated, and thus the intensity of the surface attractions is greatly reduced. An increase in the valency of the combined metal ions progressively decreases this effect.

Various materials will separate the surfaces and reduce their mutual attraction, the effect appearing to be chemical in character rather than the simple adsorption of protective colloids of the ordinary type. L. V. W. C.

25. Drilling Progress is Advanced by Improved Muds. B. Mills. *Oil Weekly*, 26.12.34, **75** (1), 22.—Several drilling problems in formations that were formerly regarded as definite barriers to deep development have been partly solved by an improvement in the quality, adaptability, and control of drilling fluids.

Greater depths have been obtained by the use of engineered mud combinations and the application of a well-balanced and chemically treated mud.

Wall building qualities of drilling fluids are being given attention by many companies, and it has been determined both by experiments and actual experience that the percentage of colloidal material in a drilling fluid is one of the principal factors to be considered.

The time element in wall building has become a recognised factor in drilling caving and heaving formations, and a mud that requires a long period of time for building impervious walls is not desirable.

The method of treating and handling drilling fluid has attracted considerable attention. The chemical treatment of the mud consisted principally of adding a solution of quebracho and caustic soda continuously to the mud during the period of difficult drilling.

Vibrating screens are used in many places, and a special mud machine which cleans and reclaims the drilling fluid as it comes from the well has been set up by the Pure Oil Co. at Dickinson near Houston.

Where weight is not a principal factor, lighter and thinner muds are being used extensively. In the higher pressure areas the heavier muds are still popular. In areas where there is a danger of blowouts thin muds are being used, and drilling wells have been controlled with a surprisingly small differential between the pressure exerted by the drilling fluid and formation pressure.

Such factors as colloidal content, weight, chemical treatment to prevent gas cutting, and ability to carry cuttings to the surface are being studied. L. V. W. C.

26. Mud Conditioning on Gulf Coast. N. Williams. *Oil & Gas J.*, 8.11.34, **33** (25), 10.—More consideration is being given by Gulf Coast operators to methods and equipment for controlling and conditioning the mud with a recognition of the important functions of drilling fluid in overcoming many of the troubles experienced.

Elaborate mud systems are being used by many of the operators, one system embodying a comparatively new mud "cracking" process.

In the operation of this system the returns from the well are directed into a combination surge and settling-tank. This tank, which has a conical-shaped bottom and a capacity of 50 brl., has an arrangement of baffles to force the incoming stream of cutting-laden fluid to travel in a circular direction to a skimmer from which the fluid enters the cracking machine.

The cracking machine is a centrifugal machine in the high-speed action of which the clays and shales of the fluid are broken down and thoroughly mixed with the water into a homogeneous, stable, and colloidal mixture. Air and gas are released, as are coarse sands and other materials during this operation.

From this machine the fluid flows through a high-velocity steel ditch into one end of a long, rectangular earthen pit. The fluid flows slowly in successive steps to the end of the pit, where the pumps are fed.

Complete records of the condition of the mud have been kept, and at no time has the sand content been much above 5%.

Throughout the drilling the mud has been carried at a weight of from 9·5 to 10 lb./gal. with a viscosity of 25–40 cp. This light weight and viscosity have been possible due to the effective consistency of the fluid. L. V. W. C.

27. Flowing Wells Naturally. W. J. Crites. *Oil Weekly*, 12.11.34, **75** (9), 41.—An intelligent control of the natural forces existing in the reservoir is necessary if the greatest benefit is to be obtained therefrom.

Unit operation and common agreement on methods of recovery assist in solving the problem, but the difficulties which still exist, even in such circumstances, can only be reduced to any great extent when the scientists are in agreement in the interpretation of their findings and engineers are in agreement in the methods of practical application.

Pools may be classified into three groups: (1) Water energy, (2) Water and Gas energy, and (3) Gas energy.

The Eldorado pool in Kansas is an excellent example of the first group. In this pool no appreciable gas occurred in solution, and reservoir pressures were of such magnitude that oil would rise to the surface.

In the second class, in which oil has considerable gas in solution but with critical pressure of release far below the reservoir pressure, the physical requirements are few and simple. Uniform reservoir pressure must be maintained along the oil-water contact, and at such value that the release of gas energy in the flow string will support the flow of fluid to the surface. The operating pressures must of course be maintained above the critical pressure of gas release.

The third class of pool is very similar to the second, and it is only through the analysis of fluid samples of the virgin reservoir that they can be segregated.

In order to operate a pool of this type efficiently, certain data must be obtained, but unfortunately many of the conditions can be determined only after considerable development work has been done. It is evident, therefore, that a new pool of this type should be rigidly restricted in production until such time as the necessary information is obtained. L. V. W. C.

28. New Hydraulic Pump for Deep Wells. F. W. Lake. *Petr. World* (LA), 1934, **31** (10), 17.—Known as the Kobe Hydraulic Pump, this unit eliminates the use of sucker rods, and by its use the wear of tubing and casing is so greatly reduced that pumping

crooked holes is no longer a problem and economical pumping can be carried to greater depths and smaller wells. At a piston speed of 60 ft./min. the rated capacity of the 2¼-in. pump is 100 brl./day. Velocities in both the 1½-in. pressure tubing and 2½-in. production tubing are less than ½ ft./sec. The unit is designed to operate against a maximum pressure of 4000 lb./sq. in., corresponding to a static head of 10,000 ft. The hydraulic pumping unit, by applying power at the pump in the well, eliminates the sources of power loss in the ordinary mechanical equipment such as sucker rod and tubing stretch and friction, and hence makes possible overall efficiencies of between 50 and 70%. The pump consists of two main units: the surface or hydraulic power unit and the subsurface or production unit. The only additional equipment is the production tubing, the inner or pressure tubing, and the connecting flow lines. One power unit will operate a predetermined number of production units. The pressure tubing conducts the power fluid (oil) from the power unit at the surface to the production unit in the well, and the space between the pressure tubing and production tubing permits the return to the surface of both power and production fluids. W. W.

29. Mechanical Down Time Analysis Advances Pumping Technique. I & II. I. F. Bingham. *Oil Weekly*, 26.12.34, **75** (11), 15; 3.12.34, **75** (12), 24.—These articles are the first of a series analysing mechanical down time of pumping wells, and discuss sucker rod difficulties.

The steps taken to minimise the difficulties encountered in the Greater Seminole area are enumerated in the first part, and tables and curves show how far the operations have succeeded. The second part deals with rod corrosion generally, and a list of the special types of rods being used in an attempt to overcome corrosion fatigue is given.

Tables are given showing the number of breakdowns in sucker rods for the period 1929–1933 inclusive. These lists are subdivided into all makes, tapered strings, and galvanised rods. L. V. W. C.

30. Acid Treatment of Oil Wells. R. E. Heithecker. U.S. Bur. Mines. R. I. 3251; *Oil News*, 1934, **36**, 439–440.—Describes the preparation of acid or solvent and the general procedure adopted for treating wells in the Zwolle oil-field of Louisiana. Hydrochloric acid of approximately 15% strength, to which certain inhibitors had been added to prevent corrosive action on well equipment, was pumped into the formation near the bottom of the hole through a string of pipe. In pumping wells the acid solution was pumped down the tubing after removing the sucker rods and standing valve. In other wells either the drill-pipe or a string of tubing was used. The charge of 1000 gal. was followed by 10 to 50 brl. of oil, which was pumped down the conductor pipe to displace the solvent and act as a flushing agent to clean the walls of the tubing. Some excess oil was forced into the formation, thus driving the solvent ahead of it. General practice was to allow the acid to remain in contact with the formation 48 hrs. before making production test. Average time to pump a 1000-gal. charge ranged from 30 min. to 3 hrs., depending on the pressure necessary to force the acid into the formation. Conclusions reached are that the acid method offers favourable possibilities for reviving oil production, especially in unprofitable pumping wells and as a "last chance" in testing "oil showings" in newly-drilled wells. W. W.

31. Acid Treatment of Lime Wells. P. W. Pitzer and C. N. West. *Oil & Gas J.*, 22.11.34, **33** (27), 38.—The general theory that the acid placed in the bottom of the hole would enlarge the size of the hole, and that some of the acid would find its way along crevices, enlarging them, and thus permitting freer entry of oil into the well, has not been proved. Since 1000 gal. of a 50% solution of 18° Bé HCl will consume only 1850 lb. of ordinary limestone, it is evident that little result could have been obtained by merely allowing the acid to remain in the bottom of the well.

To overcome this trouble it has been found necessary to force the acid into the formation under pressure, and for this purpose specially built high-pressure pumps have been installed to insure that the acid will be forced into the formation. For low-pressure areas high-volume low-pressure rotary or centrifugal pumps have been installed to ensure that the acid is placed in the shortest possible time, and where dolomite has to be treated a heating unit has been installed, since it has been found that in certain areas best results are obtained by heating the acid and the oil used to force the acid into the formation. In other areas it is necessary to reduce the temperature

of the acid to around 60° F. in order to retard the action of the acid, and so allow it to reach further back into the crevices.

The usual methods for placing the acid are explained. Where more than one stratum is to be treated, packers are set on tubing between the strata, and the treatment is carried out in each sand separately.

The freeing of drill pipe which has stuck in a limestone formation has been accomplished many times during the past year, the acid enlarging the hole around the stuck portion. Acid has also been used in lime tests to soften the extremely hard lime so as to facilitate drilling. L. V. W. C.

32. New Process for Removing Settlings. L. G. E. Bignell. *Oil & Gas J.*, 22.11.34, **33** (27), 34.—A new method has been successfully used in the Oklahoma City Field to remove sediment from the bottom of wells from 6100 to 6500 ft. deep.

This method consists in blowing out the settlings in the bottom by the introduction of gas through tubing run to just above the top of the settlings. The escaping gas causes the fluid above the settlings to rush upward in the annular space between the tubing and casing and carry with it the finer portions of the settlings. The fluid, gas, and sand are discharged into oil and gas separators, the oil is delivered to the lease storage tanks, the water is drained away from the trap, and the gas returned to the system for re-cycling.

This system has been successful in removing lost tools from the hole. L. V. W. C.

33. High-pressure Gas Handled by Special Reduction System. B. Mills. *Oil Weekly*, 3.12.34, **75** (12), 33.—Owing to the fact that straight reduction from a pressure of 3200–200 lb. was not practical because of freezing, a novel method for handling high-pressure gas in the Roanoke Field, La., has been developed.

This system consists principally of three regulators, a large hot-water tank, water heater, three series of coils in the hot-water tank, separator, and gasoline storage tanks.

The gas from the well is heated in passing through the first coil in the hot-water tank prior to the first and major reduction in pressure. From the tank it passes to the high-pressure regulator, and here the pressure is reduced from 3200 to about 1500 lb., and the gas is again passed through a coil in the hot-water tank.

A reduction to 400 lb. is obtained in the second regulator, and on passing through the third coil in the hot-water tank the pressure is reduced to about 200 lb. L. V. W. C.

34. Application of Thermodynamic Data to Petroleum Production Problems. W. N. Lacey and B. H. Sage. *Oil & Gas J.*, 15.11.34, **33** (26), 86.—This article discusses the application of that portion of thermodynamics which relates to the evaluation of energy transformation and accompanying physical changes in fluid systems to petroleum production problems. The methods used in this line of research at the California Institute of Technology are explained. L. V. W. C.

35. Effect of Curtailment on Ultimate Recovery. T. V. Moore. *Oil Weekly*, 19.11.34, **75** (10), 27.—The purpose of conserving the supply of crude oil is not to guarantee a supply of fuel and lubricants to the public, but to ensure that these products are available at reasonable prices. An over-supply of cheap crude oil will not substantially increase the consumption of petroleum products.

Maintenance of reservoir pressure conserves the energy necessary to produce oil, and in addition causes the oil to retain its desirable characteristics. This will inevitably increase ultimate recovery.

In "water-drive" fields the maintenance of reservoir pressure depends almost entirely on the rate of production. Where the rate is low the pressure may remain practically constant at a high value, whilst with high rates a decline of pressure results at nearly the same rate as if there were no energy supplied by the water.

The energy of compressed gas associated with the oil is of much greater importance than the energy of the water. This compressed gas increases the fluidity of the oil, and as the pressure is reduced this gas escapes from solution, thus increasing the viscosity of the oil and tending to keep it in the pores of the reservoir rock. Re-establishment of higher pressures through the introduction of gas causes very little of the gas to dissolve in the oil once the original gas has come out of solution. The energy stored in the gas causes the movement of oil from high- to low-pressure areas, and this energy must therefore be conserved if movement is to be maintained. As

little gas as possible should be removed from the reservoir, in order that the pressure may be maintained.

Conservation of gas may be achieved by compressing the gas produced and returning it to the reservoir, but in most fields such conservation must be confined to producing as little gas as possible.

Producing at the rate at which the gas–oil ratio is a minimum is an excellent method of conserving the gas, but this will mean restricting production. The use of tubing is one of the important methods of reducing gas–oil ratios.

Curtailment of production is vital to the conservation of crude oil within reasonable limits, but equitable and reasonable plans for control of production must be formulated and administered if the full benefits are to be realised. L. V. W. C.

36. Acreage and Sand Thickness as Factors in Proration. M. Albertson. *Oil Weekly*, 19.11.34, **75** (10), 33.—The purpose of this article is to define the true position of acreage and sand thickness as factors in the proration of oil and gas.

The need for proration is twofold. First, it endeavours to limit the amount produced so that it equals demand, and secondly it endeavours to prevent waste. Proration, as the meaning of the word indicates, must result in a proportional supply of production to each producer and the allowable for each producer must be determined by definite and controllable factors.

Uniform spacing of wells is an absolute requirement of proration. Thickness of productive sand is a factor additional to acreage which is required to establish the value of an oil property. Where this can be determined with reasonable accuracy and at a reasonable cost, it may be included directly as a proration factor.

L. V. W. C.

37. Influence of Casing Sizes on the Production of Oil. S. F. Shaw. *Oil Weekly*, 12.11.34, **75** (9), 35.—The ordinary formulæ which have been developed for flow of fluids in pipe lines cannot be applied to gas-lift flow on account of the complicated actions taking place. Among the factors that have been recognised as influencing gas-lift flow to any considerable extent is that of diameter.

Data have been collected during gas-lift operations at Seminole which show the relations between size of casing, bottom flowing pressure, and maximum production. Tables are given showing the quantity of oil that can be lifted through a pipe of given diameter under two sets of bottom hole pressures, and other data on the effect of casing diameter on well flow. L. V. W. C.

38. Re-pressuring with Control Method. C. E. Morris. *Oil Weekly*, 19.11.34, **75** (10), 35.—Channelling of air or gas in re-pressuring work may exist where the oil has drained out from the reservoir for long periods, leaving a loose or open sand as a result of the incessant movement of oil through it. The length of time for which a well may be revived depends on the manner in which the well has been handled and whether the air or gas has been controlled.

An air–oil ratio must be established for the producing wells as to oil and casing-head flow of gas. The intake wells should be controlled proportionately to the established ratio, and the air content should be checked up to determine the increase or decrease of volume and the exact air travel. This travel can be tested by means of a gas analyser.

Where the quantity of gas being made by the producing well exceeds the established air–oil ratio, the gas should be controlled at the casing head to stop channelling. Back pressuring will do this.

Oxidation and polymerisation of crude in badly channelled areas of long standing are taking place, and are directly a result of re-pressuring with air. L. V. W. C.

39. Natural Gas Re-pressuring. R. C. Conine. *Oil & Gas J.*, 8.11.34, **33** (25), 12.—Re-pressuring of the sands on the fields along the Alleghany River is being carried out with considerable success.

A complete laboratory is being erected in the Bradford region for testing core samples. Principal tests to be run in the laboratory will be on permeability, saturation, and porosity. Fluid-flow characteristics will be determined from permeability, the oil content of the sand will be obtained from saturation, and porosity will aid in the determination of saturation. L. V. W. C.

40. Probabilities and Wild-cats Tested through Mathematical Transputation. J. T. Hayward. *Oil & Gas J.*, 15.11.34, **33** (26), 129.—This paper is a discussion of the derivation of equations that will facilitate the making of decisions as to whether a wild-cat well should be drilled or not, or whether to purchase a part interest in royalty under wild-cat acreage. In addition, wild-cat well data are classified in such a manner that they will be available and handy for use in the equations. L. V. W. C.

Class 400. Transportation, Storage, and Distribution.

41. Applied Design and Economics of Pipe-lines. F. R. Young. *Oil & Gas J.*, 8.11.34, **33** (25), 38.—This article explains the design of an oil pipe-line showing the mathematics necessary for calculating friction loss and looping and equivalent lengths. An example illustrates the economics of pipe-line design. L. V. W. C.

42. Reconditioning of Pipe-lines. E. C. Rolfs. *Oil & Gas J.*, 25.10.34, **33** (23), 97.—Reconditioning of pipe-lines is gradually becoming a definite policy of many of the pipe-line operating companies.

The line must first be located, and this is usually done by means of a locator, which consists of a high-frequency transmitter and a specially designed portable radio receiver. The pipe-line and connections are excited by the transmitter which transmits high-frequency pulsations between two grounded points. The signal is heard by the operator when he is directly over the line.

After the line has been located, its condition must be determined. Holes should be dug at intervals and a careful inspection of the pipe made to determine the depth of the pits together with their area.

If it is decided to recondition, the pipe should be uncovered and cleaned. Patching and welding should then be carried out and some protective coating applied.

Some companies are using a detector for discovering pin holes or bare spots in the coating. Any such spots can be covered by hand daubing brush. L. V. W. C.

43. Pipe-line Bridge with Unsymmetrical Suspension Span. W. Kenan. *Petr. Eng.*, Nov. 1934, **6** (2), 43.—A bridge has been thrown across the Iowa River near North Liberty, Iowa, to carry a natural gas pipe-line, to protect the line from periodic floods and corrosion hazards.

A somewhat unusual design was necessary owing to the physical characteristics. At this spot the river has a high and precipitous rock bluff bank and a low soil bank on the opposite side, the difference in level being 60 ft.

The main pier on the high bluff side consists of two reinforced-concrete pedestals, and that on the low bank side consists of a reinforced-concrete pier superimposed on two 4½-ft.-diameter reinforced concrete shafts that extend from the normal ground surface down to solid rock approximately 22 ft. below. The top of this pier supports a main tower 42 ft. in height.

The two main cables of the bridge are 1⅞ in. diameter, with a breaking strength of 150,000 lb. and a factor of safety of three. L. V. W. C.

44. Iraq Pipe-line Completed. C. O. Willson. *Oil & Gas J.*, 25.10.34, **33** (23), 82.—The Iraq pipe-line has represented an expenditure of approximately $50,000,000, and is the most important transportation job over the past two years.

Regular deliveries of oil will be available immediately at Haifa, and will be about 21,000 brl. daily, due to the fact that all the pump-stations are not completed. This is about 50% of the capacity of the line. When the Tripoli terminal is operating at capacity, which is expected by the end of the year, and the Haifa terminal by the end of March, 1935, the line will be delivering crude oil at the rate of 4,000,000 long tons per year.

There are 12 pumping stations in the line and 45 pumping units driven by 500-b.h.p. Diesel engines. Ultimately the line pressure will be 800 lb.

Deep-sea loading facilities are available at both Tripoli and Haifa. Storage facilities at each station will be about 1,500,000 brl. when completed. L. V. W. C.

45. Another Pipe-line for Middle East. Anon. *Petr. World*, 1934, **5**, 429.—A short note on the pipe-line which is being constructed by the Anglo-Persian Oil Company from the Naft-i-Shah field to Kermanshah, where the Company is erecting a small refinery. The line is expected to be commissioned about midsummer 1935. W. W.

46. Internal Corrosion of Natural Gas Transmission Lines. E. E. Schmidt and T. S. Bacon. *Petr. Eng.*, Nov. 1934, **6** (2), 168.—The corrosion of natural gas transmission lines has presented endless difficulties, and despite the investigations aimed at its elimination, it continues to exact its toll.

The effects of internal corrosion are many and varied, each resulting in loss, but fortunately most lines, even after many years of service, show no evidence of internal corrosion. Natural gas itself has no corrosive action on pipe-lines, but certain constituents which the gas may contain will corrode the lines under favourable conditions.

The electrochemical theory of corrosion requires that liquid water be present on the pipe surface and that oxygen be present in the gas passing through the line before serious corrosion can occur.

Until the pipe reaches a temperature above 400° F., corrosion of the iron by H_2S is not appreciable in the absence of water. Even if high pressure, high H_2S concentration, and liquid water on the pipe surface were present serious corrosion will not occur unless oxygen is also present. The exact rôle of oxygen in accelerating H_2S corrosion of pipe-lines is not definitely known, and certain theories have been propounded to explain it.

It may be assumed that the corrosive rate of steel pipe is roughly proportional to the partial pressure of H_2S in the gas so long as liquid water is present and the concentration of oxygen is more than 100 times the concentration of hydrogen sulphide.

A number of ways to eliminate or reduce internal corrosion of gas transmission are suggested in this article. These include the application of coatings to the metal, the use of alloys that will withstand corrosion, dehydration of the gas entering the system, etc. Each of these methods is dealt with in some detail. L. V. W. C.

47. Application of a Few Statistical Principles to Corrosion Problems. G. N. Scott. *Oil & Gas J.*, 25.10.34, **33** (23), 74.—Certain statistical principles appear well suited to quantitatively describing the condition of a pipe-line, and the application of these principles has been illustrated by actual pit depth measurements taken from lines.

A detailed discussion of the variation in means of small samples is given, with especial emphasis on the number of samples required for a given accuracy of the mean. The prediction from small samples of the number of lengths of pipe in a system falling outside certain values of pit depths is made by means of Tchebycheff's Theorem. The exact number of pipe lengths having pit depths greater than an assigned value cannot be predicted with accuracy, but it can be definitely shown that the value of such lengths is not greater than a certain value.

Little reliable information on the condition of pipe is available, and the author suggests the collection of quantitative data by all those actively connected with the pipe-line industry. L. V. W. C.

48. Electric Motors for Pipe-lines Engaging Attention of Industry. G. R. Prout. *Oil & Gas J.*, 25.10.34, **33** (23), 60.—Efficient and reliable motor-driven centrifugal pumps have been developed for handling large volumes of oil at high pressures, and the advantages to be gained by their use are well known to pipe-line companies.

Nearly all the equipment now in use is of the constant-speed type, the simplest form of which is the squirrel-cage induction motor. In some cases slip-ring induction motors with variable speed control have been used to drive reciprocating as well as centrifugal pumps. The efficiency of the slip-ring motor decreases in proportion to the reduction in speed if the torque developed is constant. This is the condition usually obtained when the motor is driving a reciprocating pump at different speeds.

Where pumping requirements vary considerably from day to day, the brush-shifting type of adjustable-speed A.-C. motor has many advantages.

Explosion-proof motors are used in large numbers where explosive atmospheres are present.

In the majority of installations standard control equipment is used. Where the slip-ring type of motor is being used, the control equipment is of the manual type, frequently providing for speed reduction up to 25%.

Remote control has been used in synchronous motors, and overload and under-voltage protection has been afforded in these cases.

Certain automatic features can be applied to all the control equipment, such features as pressure switches and relays being common. L. V. W. C.

49. Standardization of Valves and Fittings. Anon. *Oil & Gas J.*, 8.11.34, **33** (25), 11.—An endeavour is being made by several of the major pipe-line companies in Tulsa to bring about standardization of pipe-line valves and fittings. A preliminary report is ready for presentation, and the table prepared by the committee appointed to investigate conditions showing the proposed standards is given in the article. L. V. W. C.

50. Progress in Oil Pipe-line Operation. W. G. Heltzel. *Oil & Gas J.*, 25.10.34, **33** (23), 36.—A comprehensive article dealing with the progress made in oil pipe-line operation. Pumping and heat exchange practices are dealt with, and some of the methods adopted to combat corrosion are explained. L. V. W. C.

Class 500. Properties and their Determination.

51. Application of Physico-chemical Principles to the Design of Liquid-Liquid Contact Equipment. Part III. Isothermal Flow in Liquid Wetted-wall Systems. R. Fallah, T. G. Hunter, and A. W. Nash. *J.S.C.I.*, 1934, **53**, 369–379T.—This paper describes the hydrodynamical characteristics of both single and double liquid wetted-wall systems. Experimentally, the authors have determined wall layer thickness with a stationary air core, a stationary oil core, and a moving oil core. The subject has been treated theoretically and an expression evolved whereby layer thickness is related to the system variables, which can be ascertained, and the interfacial velocity, which latter cannot be determined. By considering four cases, which cover the possible values of the interfacial velocity, expressions are obtained and correlated with the experimental results. It is concluded that the wall liquid layer thickness in both single and double wetted-wall towers for isothermal streamline flow of the wall liquid with a stationary core can be given by a single formula, and that the velocity at the interface between the two liquids is a maximum under these conditions. It is pointed out that the core is never completely stationary because at all wall liquid rates, local currents are set up, due to the motion of the wall liquid. W. E. J. B.

52. Investigation of Lubricating Value. V. Vieweg. *Öl und Kohle*, 31.10.34, **2** (11), 494–501.—This is a report of the session on this subject of the German Institution for the Investigation of Mineral Oils held on April 28, 1934. Experiments carried out at the Technical Institutes at Dresden, Karlsruhe, and Munich, respectively, are described. Physical and chemical research shows that the molecular forces between the limiting surfaces and the lubricating media are dependent on the lubrication value. A method for the quantitative determination of this property is being considered. W. S. E. C.

52a. Diesel Engines and their Fuel Pumps. Streitberger. *Öl und Kohle*, 31.10.34, **2** (11), 501–505.—This article also describes the work of the institution mentioned in the above abstract. Injection pumps and those dependent on stroke regulation, needle control, suction and steering devices for different Diesel motors are discussed. W. S. E. C.

53. Viscosity Index for Bituminous Material. H. Lenhard. *Asphalt u. Teer*, 1934, **43**, 867–871.—In this article the author compares his treatment of the Hoepfner-Metzger straight-line law for bitumens and tars, with the Eymann system of viscosity-temperature relationship. Numerous examples are given and comparative results tabulated.

The article concludes with a reference to his original work contributed by Metzger, to which the author replies. J. L. T.

54. Determination of Absolute Viscosity using Redwood No. 1 Viscometer. E. A. Goode and T. V. Heath. *J. Inst. Petr. Techn.*, 1934, **20**, 1054–1056.—An account of results obtained with a Redwood No. 1 viscometer which gave a modified equation for conversion of Redwood time to viscosity in absolute units. G. R. N.

55. Catalysis in the Hydrogen Bromide–Olefines Addition. V. N. Ipatieff, H. Pines, and R. C. Wackher. *J.A.C.S.*, 1934, **56**, 2398–2400.—The reaction between propene and an acetic acid solution of hydrogen bromide is promoted by organic non-polar liquids, *e.g.* hexane, *cyclo*hexane, and benzene. Polar compounds such as water,

alcohol, or acetic acid have no promoting effect. The speed of the addition reaction depends on the nature of the solvent used, and the reaction is autocatalytic in nature, since the bromides formed are themselves catalysts for the reaction. W. E. J. B.

56. Action of the Silent Discharge on Hydrocarbons. A. W. Nash, J. L. Howard, and F. C. Hall. *J. Inst. Petr. Techn.*, 1934, **20**, 1027–1043.—An account of published work on the action of the silent discharge on hydrocarbon gases and oils. G. R. N.

57. Relation between Boiling Points of Hydrocarbons and their Structure. R. L. Wakeman. *Rec. Trav. Chim.*, 1934, **53**, 832.—In consequence of van Arkel's work on the relation between physical constants and constitution of consecutive members of a homologous series, the author has summarised previous work on this subject.

Young's empirical formula for the calculation of b. p. in homologous series holds approximately for paraffins, olefines, diolefines, and acetylenes, satisfying the general formula $R_1(CH_2)R_2$, in which R_1 and R_2 are acyclic hydrocarbon residues.

If the b. p. of the members of the series are plotted against the number of C atoms, smooth curves are obtained parallel to each other in the lower range. From these curves, or by tabulating the data, it can be seen that the b. p. of at least the C_5 to C_9 members are in close relationship with the b. p. of the *n*-paraffins having the same number of C atoms. In general, a fixed change of constants will be found by passing from a *n*-paraffin to an isomeride or a homologue.

The b. p. differences are approximately additive when the structure has at least one CH_2 group between the side-chain and the multiple bond. Examples of the calculation of the b. p. of an unsaturated (chained) compound from a given acyclic hydrocarbon are given.

The influence of one double bond on another is striking and shows an "exaltation" in the conjugated position. Examples are given in which such a calculated b. p. proved to be a valuable check to the identification of hydrocarbons. P. C. K.

58. Ring Compounds and Polymers from Polymethylene Dihalides and Dimercaptans. J. R. Meadow and E. E. Reid. *J.A.C.S.*, 1934, **56**, 2177–2180.—Sulphide dimercaptans have been identified as by-products in the preparation of simple dimercaptans. Ring compounds have been obtained by the reaction of a polymethylene halide with a polymethylene mercaptan and also high molecular-weight polymers. Exchange of radicals between an alkyl sulphide and an alkyl halide has been effected. W. E. J. B.

59. Hydration Rate of Trimethylethylene. H. J. Lucas and Yun-Pu Liu. *J.A.C.S.*, 1934, **56**, 2138–2140.—Trimethylethylene is hydrated in aqueous nitric acid to tertiary amyl alcohol. W. E. J. B.

60. Preparation of Acetylenic Materials. T. H. Vaughn, R. R. Vogt, and J. A. Nieuwland. *J.A.C.S.*, 1934, **56**, 2120–2122.—A method of preparing sodamide is described and its use is illustrated by the preparation of eight substituted acetylenes. W. E. J. B.

61. Addition of Iodine and Thiocyanogen to Unsaturated Compounds. P. B. Caldwell and F. A. Piontkowski. *J.A.C.S.*, 1934, **56**, 2086–2089.—Iodine and thiocyanogen numbers for unsaturated compounds of various types, *e.g.* oleic, erucic, maleic acids, etc., have been determined by the Hanus method (1 and 2 hrs.) and the Kaufmann method (47 hrs.), respectively. The thiocyanogen is much less reactive than iodine, and both reagents give results which are subject to the steric hindrance effects of negative groups in the vicinity of the ethylene bond. The effect decreases with the distance of the negative group from the ethylenic linkage. W. E. J. B.

62. Improved Form of Sulphur Determination Apparatus. F. Esling. *J. Inst. Petr. Techn.*, 1934, **20**, 1051–1053.—A description of the modified and improved form of the author's apparatus for the determination of sulphur in petroleum distillates. G. R. N.

63. General Properties of Rumanian Petroleums. E. E. Casimir. *Petr. Z.*, 1.11.34, **30** (44), 1–16.—This concludes the article commenced in abstr. 1471/1934, and is a report of investigations carried out on Rumanian petroleums in the chemical laboratory of the Geological Institute of Rumania at Bucharest. A short *résumé* of the properties of the petroleums from various fields is given in the following :—

The regions of Mislea Teis and Runcu–Süd yield benzines which are richest in aromatic hydrocarbons. The crude oils from the Bustenari field near Runcu produce lubricating oils of low sp. gr. and high flash point, and the content of naphthenic acids is less than the corresponding oils from Moreni and Ochiuri, but greater than those from Baicoi.

The crude oil from Boldesti contains only slight traces of naphthenic acids.

From the Baicoi–Tintea field the Baicoi yields a Dacian crude containing very little paraffin and a meotic crude which is paraffinic. The Dacian benzine contains very light constituents. The Tintean crude oil has a high sp. gr.; the benzines are very light and contain 8–11% of aromatic, 48–52% of naphthenic, and 39–42% of paraffin hydrocarbons.

The strata of the Copăceni–Gura–Vitioarei field contain oligocenic and meotic sandstones. The Copăceni benzine contains very little aromatic hydrocarbons similar to Ochiuri benzine, but differs from most Rumanian hydrocarbons, which usually have a high aromatic content. The crude oil also has a very low paraffin content. The Scaiosi crude contains 3% of paraffin.

The Cepturan and Aricesti crude oils are both paraffinic. The Arbanasi–(Policiori) strata contain meotic oil-sands which are paraffinic compared with other Rumanian oils, but have a higher content of aromatic hydrocarbons than other benzines and a high kerosine content.

Regarding the Sărata–Monteoru field the meotic layers yield crudes of high sp. gr., and produce very little light benzine.

Two fields are dealt with in the Moldau (Bezirk–Bacău) region. First the Tetcani region contains petroleum in sands and conglomerates of miocene salt formation. The light benzine contains 19·6% of aromatic, 32·4% of naphthenic, and 48% of paraffin hydrocarbons. Secondly, the Moinesti field contains meotic crude oil poor in paraffin and oligocenic strata yielding crude oil of 7·5% paraffin content. A mean sample of benzine is found to contain 6·8% of aromatic, 43·5% of naphthenic, and 49·7% of paraffin hydrocarbons. The Stanesti and Zemes fields are oligocenic.

Several tables are given of distillation data and properties of the crude oils and their constituents. W. S. E. C.

64. Water Vapour Content of Natural Gas. L. E. Woodruff. *Oil & Gas J.*, 22.11.34, **33** (27), 39.—This article deals with the determination of water vapour in natural gas as it pertains to collecting systems, particularly where the gas reaches the plant at atmospheric pressure or less.

A liquid tends to evaporate and fill the surrounding space with its vapour at a pressure which at any particular temperature is fixed and is known as its vapour pressure. When a gas and water are brought into contact, the water begins to evaporate, and if they are left in contact for a sufficient length of time, evaporation will continue until the partial pressure of the water vapour will equal the vapour pressure of the water. The gas is then said to be saturated.

The mol. fraction of vapour in such a mixture may be expressed as the ratio of vapour pressure to total pressure, and it is therefore apparent that the maximum amount of vapour which a gas can hold increases with increasing temperature and decreasing pressure.

In order to determine the mol. fraction of water vapour, a dewpoint hygrometer has been found to be satisfactory.

The aqueous dewpoint of a gas is defined as the temperature at which the partial pressure of water equals its vapour pressure. A gas under these conditions is said to be saturated, and any decrease in temperature will cause water to be condensed.

Advantage is taken of this fact in the determination of the dewpoint by directing a stream of the gas to be tested, against a polished metal surface, which is then cooled until dew is seen to appear. This temperature gives the partial pressure of the water vapour in the mixture.

The mol. fraction of water vapour may be calculated from the following relationship:

$$X = \frac{VP}{P},$$

where X = mol. fraction of water vapour, VP is the vapour pressure of water at dewpoint, and P is the total gas pressure.

A description of the dewpoint apparatus is given together with the method of operation. L. V. W. C.

65. Physico-chemical Researches on the Oxidation of Cracked Spirit. E. Vellinger and G. Radulesco. *Ann. des Comb. Liq.*, 1934, **9**, 901–924.—The use of ultra-violet light to accelerate the oxidation of cracked spirit at ordinary temperatures has been studied. The fuel is placed in a pyrex vessel, the air being displaced by oxygen and the rate of absorption of the latter noted. Experiments were made both at constant pressure and constant volume, gum being determined on the oxidised sample by the air-jet method.

Oxygen is essential for gum formation, only slight traces of the latter being produced when an inert gas is used. Oxidation proceeds in the dark also, but more slowly, and it was found that for the same volume of oxygen absorbed, the amount of gum formed in the dark was the same as that formed under the influence of light, the latter merely acting as a catalyst. The volume of oxygen absorbed is not proportional to the amount of gum formed, but the ratio of the latter to the former is less the more refined is the gasoline. The rate of absorption of oxygen is considered, however, to be a criterion of the stability of the fuel on storage. In some cases the rate of absorption is regular following a linear rule, *e.g.* with simple olefines with one double bond, whilst in others an initial induction period is followed by a rapid rise in absorption. The simple olefines as well as the more complex unsaturated bodies contribute to gum formation, but the amount of gum formed per unit volume of oxygen is greater the higher is the mol. wt. of the gum-forming constituents. Anti-oxidants prolong the induction period, and the efficiency of inhibitors can be readily investigated by the photolysis method.

An attempt was made to remove the more readily oxidisable constituents of cracked spirits (which give rise to peroxides and accelerate gum formation) under such conditions that no gum is formed. Potassium dichromate in acid solution seems to be the most satisfactory reagent yet tried for this purpose. C. C.

66. Factors affecting the Gum Stabilities of Gasoline. T. L. McNamara. *Refiner*, 1934, **13**, 381–385.—Gasoline in contact with air at first slowly absorbs oxygen with little increase in gum. In a second stage the rate of absorption of oxygen increases, and in a relatively short time the hitherto gumless gasoline may develop sufficient gum to render it unsaleable. The first stage is termed the induction period, and for a given gasoline its duration varies inversely as the temperature. In the laboratory it is measured with an oxygen bomb at 212° F.

After advancing experimental evidence, the author concludes that :—(1) Exposure to sunlight greatly accelerates gum formation ; (2) Doctor treating a freshly distilled gasoline lowers its induction period ; (3) Fresh doctor reduces the induction period to a greater extent than reclaimed doctor. In the latter case the induction period of the untreated sample may not differ appreciably from that of the treated ; (4) Blending straight-run gasoline with cracked gasoline is not effective for raising the induction period ; (5) Sulphur in small amounts does not affect the induction period appreciably ; (6) The relative efficiencies of gum inhibitors vary for different gasolines. B. C. A.

67. Ageing of Lubricating Oils and their Products. H. and W. Müller. *Petr. Z.*, 7.11.34, **30** (45) ; *Motorenbetrieb*, **7** (11), 5–6. The difference in the saponification values of fresh and used lubricating oils is used as a means of determination of the acidic character of the used oils. The addition of very small quantities of finely-divided metals and oxides and metal salts of fatty acids to the oils did not increase the saponification value. The ageing was delayed by the addition of 0·1% of the following organic compounds : nitroaniline, *p*- and *m*-phenylenediamine, urea, semicarbazide, guanidine, α- and β-naphthylamine, and delayed to a great extent by resorcinol, pyrogallol, phloroglucine, α- and β-naphthol, *p*-nitrophenol, Borneol and Japanese camphor. It is claimed that the oxidation of lubricating oils causes the intermediate formation of ozonides and peroxides and subsequent formation of aldehydes, acids, and lactones. The used lubricating oil was treated by shaking with soda lye and the hydrocarbons were removed by means of petroleum ether. The oxidation products formed were divided into solid and liquid components, the latter consisting of a compound of the formula $C_8H_8O_3$. W. S. E. C.

68. Lubricating Oils and Cancer. Anon. *Oil & Col. Trades J.*, 1934, **86**, 1278–1279. —This article deals with the recent report of the Manchester Committee on Cancer, summarises the conclusions, and gives details of the suggested standard for spindle oils. Mule-spindle mineral lubricating oils should have a refractivity below 0·5520 when the sp. gr. is above 0·895 or a refractivity below 0·5550 when the sp. gr. is below 0·895. The method of applying the approved lanolin–olive oil mixture to the skin is detailed, and the article concludes with a note on the doubtful efficacy of this mixture as a guard against cancer from tar. J. L. T.

69. Carcinogenic Properties of Oils. D. L. Woodhouse. *J. Inst. Petr. Techn.*, 1934, **20**, 1057–1063.—An account of tests on mice that indicated that certain synthetic lubricating oils were non-carcinogenic while SO_2 extracts of spindle oil contained carcinogenic constituents. G. R. N.

70. Meeting of German Association for the Investigation of Mineral Oils. April 26–28, 1934. Testing, Research and Nomenclature. *Öl und Kohle*, 15.10.34, **2** (1), pp. 463–468. **Testing of Lubricating Oils in Practice.** K. Krekeler. An account is given of the session held dealing with this subject. The author describes theories of layer lubrication and the testing of turbine, cutting, transformer, and steam cylinder oils.

(2) pp. 468–470. **Erren-Hydrogen Motor.** W. von Rosenberg. A description is given of this motor and its application in chemical industries where hydrogen is available as a by-product. It is also used for U-boats, railway engines, omnibuses, and tractors.

(3) pp. 471–474. **Evaluation of Used Lubricating Oils.** F. Evers.

(4) pp. 475–477. **Evaluation of Used Lubricating Oils.** E. Riedel.

The last two papers deal with impurities present in these oils and methods of regenerating transformer, insulating and machine oils. W. S. E. C.

71. Asphaltic Bitumen Emulsions. F. H. Garner, *J.S.C.I.*, 1934, **53**, 1000–1003. —This paper deals chiefly with the properties of asphaltic bitumen emulsions and their relation to practice. Processes for the manufacture of emulsions and properties and manufacture of bitumen for emulsification purposes are briefly discussed. A. O.

Class 600. Refining and Refineries.

72. Theoretical Considerations of Fractional Distillation and Condensation. M. Frenc. *Refiner*, 1934, **13**, 390–394.—Following discussion of the difficulties encountered in the solution of distillation problems according to the usual methods, qualitative conceptions based on Nernst's distribution law are developed, leading to the conclusion that the greater the temperature difference between adjacent trays of a bubble tower, the better is the fractionation, all other factors being equal, and that a great temperature difference at a constant top temperature involves an increased heat supply at the bottom. B. C. A.

73. Cannock Process of Low-temperature Carbonisation. C. H. Lander. *Petr. Times*, 1934, **32**, 461.—The novelty of this process is claimed to lie in the nature of the charging stock, namely, a 50/50 mixture ("colloidal" suspension) of pulverised coal and creosote. This artifice is stated to solve the heat transfer problem, with a consequent reduction of heating time and destructive decomposition. In the particular plant referred to the temperature for optimum yield is 450° C. and the working time 2¾ hrs. per charge, inclusive of time occupied in topping.

The yields per ton of coal are given as: Petrol (washed and ready for marketing), 15·3 gal.; Smokeless fuel, 15 cwt.; Oil, 4½ gal.

The oil is returned to fresh charging stock. Gas is produced in sufficient quantity to provide most of the heat for the retorts.

The octane number of petrol is given as 89 and is blended before distribution. H. G.

74. Chemical Conversion of Peat Tar. E. V. Rakovskii. *Foreign Petr. Techn.*, 1934, **2**, 197–198.—Two Russian peats were investigated. The tars were produced by carbonisation in either a coking plant or in a gas producer. These tars were low in gasoline content, probably due to loss of light fractions. They were characterised

by the presence of 7–8% peat waxes, a mixture of acids and esters of m. p. 80–82° C. and having a well-defined crystal structure. These waxes were separated from the tar by first mixing the latter with gasoline, removing tar bases with dilute acid, chilling, then filtering or centrifuging. Phenol and its homologues were also present in the tar, and were separated by the usual methods. The neutral oil was only suitable as a fuel oil. G. R. N.

75. Destructive Hydrogenation. M. S. Nemtzov and A. V. Frost. *Khim, Tverdogo Topliva*, 1932, **3**, 537–559.—A critical review of the following items is presented: (1) Influence of the hydrogen pressure on the process chemical equilibrium; (2) hydrogenation of aromatic hydrocarbons; (3) the possibility of lowering the operating pressure; (4) velocity of the reaction and hydrogen pressure; (5) hypothesis on the mechanism of the process; (6) the influence of the state of the product under hydrogenation on the process; (7) the methodical investigation of the hydrogenation process. A bibliography containing 38 references is appended. Foreign Petr. Techn.

76. Conversion of Mineral Oils. H. Herbst. *Chem. Z.*, 1934, **58**, 881.—For the conversion of mineral oils potassium silicate on active carbon or pumice has been proposed, or active carbon or pumice impregnated with KCl or K_2SO, with small amounts of Na_2CO_3,NaCl if desired. All carriers must be dried after impregnation. Purification has further been proposed by the use of a strong solution of zinc chloride. L. S.

77. High-pressure Hydrogenation of Naphthalene in the Presence of Nickel on Kieselguhr as a Catalyst. H. I. Waterman, J. F. Clausen, and A. J. Tulleners. *Rec. Trav. Chim.*, 1934, **53**, 821.—A purified naphthalene was hydrogenated at high pressure with nickel on Kieselguhr as a catalyst, the working temperature being about 230° C. After the catalyst was poisoned the consumption of hydrogen was more than that calculated for tetrahydronaphthalene. The physical constants of the reaction product are somewhat low for tetrahydronaphthalene, and no cracking had occurred, so that it may be concluded that the hydrogenation had proceeded further than the tetralin stage.

The liquid product obtained was again hydrogenated with a fresh portion of the same catalyst at 180° C., the product being a completely saturated liquid, which did not solidify when cooled to −80° C. The constants were between those generally found in the literature for *cis-* and *trans*-decahydronaphthalene, and the distillation curve agrees with this supposition. The experiment was repeated with a larger quantity of commercial-grade naphthalene at a working temperature of about 300° C. Hydrogenation commenced at a higher temperature than in the experiment with purified naphthalene, and also it was impossible to proceed with the hydrogenation further than the tetrahydronaphthalene stage with the same portion of catalyst. Again, it was observed that the hydrogenation of *tetra-* to *deca*-hydronaphthalene started at a lower temperature than the hydrogenation of naphthalene to tetralin. No cracking occurred. The reaction product had properties between those of *cis-* and *trans*-decahydronaphthalene and a fraction of higher mol. wt. had been formed, so that side-reactions must have taken place. By continued heating of the completely hydrogenated product at 260–300° C. under high hydrogen pressure and in the presence of the Ni-catalyst conversion into the *trans*-form occurred, as was shown by the lowering of sp. gr., refractive index, and increase of aniline point and sp. refractivity.

The suggestion of isomeric change is based on the data for *cis-* and *trans*-decahydronaphthalene given by Hückel.

The formation of a completely saturated product of high mol. wt. containing more than 3 rings per molecule and also of a saturated ring system mixture, having about 2 rings per molecule with a very low sp. gr. and refractive index, lower than that of the *trans*-decahydronaphthalene described in literature, is noted. P. C. K.

78. Isolation of a Natural Inhibitor from Rumanian Cracked Distillate and its Application to Selective Acid Refining. F. Sager. *J. Inst. Petr. Techn.*, 1934, **20**, 1044–1050.—An account of experiments on the acid treatment of Rumanian Dubbs P.D. and the effect of the treating conditions on the gum tests of the finished gasoline, together with the use of the phenolic compounds extracted by the soda as gum inhibitors. G. R. N.

79. Anhydrous Ammonia in Refining. E. R. Woodward. *Oil & Gas J.*, 13.9.34, **33** (17), 33.—The possible uses for ammonia in petroleum refining include: (1) Refrigeration in the dewaxing of lubricating oils and in the low-temperature acid refining of cracked distillates; (2) corrosion prevention in stills, cracking units, reflux systems, and Lachman treating units; (3) neutralisation of acid-treated stocks.

(1) Refrigeration by ammonia cooled brine in three stages is usually employed for dewaxing purposes. Treating cracked stocks at low temperatures results in the acid requirements being reduced by 40%, treating losses by 30%, and polymerisation losses by 70%, and in the absence of acid reaction in the naphtha, the rapid settling of sludge, and consequent freedom from emulsion troubles during washing, etc.

(2) The most widespread use of ammonia is in the neutralisation of acidic liquids and vapours in distillation equipment. Iron sulphide formed by the corrosive effect of H_2S on iron appears to act as a protective coating to the iron, but this dissolves in the HCl formed by the decomposition of any $MgCl_2$ present, releasing further H_2S. The advantages of ammonia neutralisation are that it is easy to handle and inject, cheap and simple to control, whilst handling hazards are small. Good contact is immediately obtained between the vapours, resulting in thorough neutralisation. In crude distillation units the ammonia is injected from a cylinder into the vapour line between the top of the tower and the first heat exchanger or into the naphtha section of the tower, if the reflux gasoline contains any condensed acid water. Condenser coils may be protected by injecting two-thirds of the ammonia into the line between the heat exchanger and the condenser box. In the condensing end of the cracking unit the ammonia must not be allowed to cool below 50° F. in order to provide sufficient pressure to overcome the cracking back pressure. It is not suitable for use in cracking coils owing to the dissociation of the ammonia–sulphur compounds formed, hydrated lime or caustic soda being preferred. SO_2 evolved during the redistillation of acid treated oils, H_2S present in reflux lines, and HCl formed in the Lachman zinc chloride process are also conveniently neutralised by ammonia.

The methods of flow control, *i.e.* flow meters and ammonia reducing valves, are discussed, and reference is made to the use of the *p*H value for the chemical control of the efficiency of the neutralisation.

(3) The treatment of acid stocks (lubricating oils and pressure distillates) with ammonia obviates the formation of heavy emulsions, eliminates redistillation, produces bloomless and better-coloured oils, and eliminates ash in the finished oils.

A mixture of alcohol and ammonia may also be used for removing sulphates and naphthenates from residuums and for neutralising heavy cylinder oils to produce petrolatum or white oils, in preference to solid alkalis, which produce less easily filterable products. C. L. G.

80. Modern Methods of Processing Lean Gas. N. Williams. *Oil & Gas J.*, 22.11.34, **33** (27), 11.—A gasoline plant is being successfully operated on ultra-lean gas by the Nueces Refining Co. in the Aqua Dulce Field, Texas. When the gas is received at the plant it has a fluid content of only 0·15–0·25 gal./1000 cu. ft., the remainder having been removed at the wells.

The large volume of gas available and the high degree of efficiency which has been obtained by the installation and operating practices have made it possible and practical to operate this plant with such lean gas.

Approximately 40,000,000 cu. ft. of gas are supplied daily by 8 wells, and the gas is received by the plant at a pressure of 370 lb. At the wells about 450 brl. of fluid is trapped off from the gas. This is run separately through a small topping unit, where approximately 95% is recovered as gasoline and 3% as naphtha; the remaining 2% is lost in distillation.

Mineral seal or other special absorption oils have been eliminated by the use of a part of the naphtha as absorption oil in the gasoline plant. Fuel costs have been reduced to a minimum and a closed steam system has reduced the water requirements.

A central-cooling system is provided, all the condensing and cooling coils being concentrated in the base of the one water-tower. One operation does all the condensing of vapours and cooling of hot oils and hot water, and although it is simple it is adequate, and does away with the necessity of installation of special condensing equipment.

The gas from the field is directed into the absorption tower under pressure of 370 lb., where the gas coming into contact with the naphtha absorption oil is stripped

of its gasoline content and passes off into a scrubber and from there to the vent line. The constant desired back pressure on the absorption tower is controlled by a relief valve.

From the absorber to the still there is a drop in pressure from 370 to 40 lb.

Control and operation of the plant is entirely automatic, with all instruments centralised at one board. L. V. W. C.

81. Comparison of Coal Tar Oil and Gas Oil for Absorption. G. V. Kopelevich. *Foreign Petr. Techn.*, 1934, **2** (6), 202.—In the absorption expts. the gas oil, sp. gr. 0·881, I.B.P. 255° C., 15% at 300° C., 46% at 330° C., mol. wt. 252·2, vapour pressure 5·7 was compared with a coal-tar oil sp. gr. 1·042, I.B.P. 230° C., 89% at 300° C., mol. wt. 140·7, vapour pressure 14·0, naphthalene 3%, phenols nil. In the determination of the vapour pressure of benzene in these oils it was found that Henry's law did not hold. The absorption ability was determined by the increased vapour pressure of the benzene in gas oil as compared with that in the coal-tar oil at the same temperature. G. R. N.

82. Inhibitor Dyes in Cracked Gasoline. Anon. *Oil & Gas J.*, 4.10.34, **33** (20), 35.—A brief summary is given of a paper recently presented by C. P. Lowry, G. Egloff, J. C. Morrell, and C. G. Dryer to the A.C.S., discussing research work on the preparation of dyes for gasoline with definite inhibiting properties. The colours and inhibiting values (measured by *cyclo*hexene number) of a series of azo and indophenol dyes are given. The latter type on reduction to the leuco-compound yield powerful inhibitors, which also deepen the colour of the mixtures as induction proceeds and the leuco-compounds are oxidised back to the indophenol. As oxidation proceeds, however, the colour fades. It is frequently necessary to add only sufficient dye to give the desired tint, and complete the protection with some other colourless inhibitor, in order to avoid over-colouring the gasoline. Oxidation of a mixture of dye and inhibitor appears to be simultaneous, so that the depth of colour is also a measure of the concentration of the colourless inhibitor. C. L. G.

83. Application of Gum Inhibitors to Motor Fuels. W. H. Hoffert and G. Claxton. *Petr. Times*, 1934, **32**, 517.—The authors deal with the use of inhibitors in the production of motor benzole. The combined use of cresol and catechol is now being recommended as giving the best factor of safety in regard to gum formation and better colour stability in storage. Their use involves the observance of certain precautions. They should be added during the final distillation or immediately after distillation and before blending. Alkalis should be entirely absent, even water being sometimes sufficiently alkaline to cause discoloration. In refining processes in which alkalis are used a final wash with an acid salt is recommended. Experience has shown that inhibited benzols are satisfactorily stable in storage, and that their use in alcohol blends does not give rise to trouble if adequate care is taken of the quality of the alcohol. H. G.

84. Chlorex Process. D. B. Williams. *Oil & Gas J.*, 20.9.34, **33** (18), 13.—The trend towards lighter lubricating oils is likely to cause increased demand for neutral oils and decreased demand for bright stock. Present practice in mid-Continent refining is to refine the long residuum or topped crude and then to separate it into neutrals and bright stock. If, however, the neutrals are taken off before refining, only sufficient of the resulting residuum necessary to produce the bright stock required need be processed, the remainder being cracked or blended with fuel oil. Overhead neutrals, being free from asphalt, can be readily treated by the Chlorex process. The results of extraction tests on various mid-Continent and Pennsylvanian oils are given, it being shown that a viscosity index equivalent to Pennsylvanian can be obtained from mid-Continent oils, with yields of 75%. The resistance of Chlorex treated mid-Continent oils to sludging and oxidation and their colour is materially improved, whilst percolation or contact clay yields are higher. The use of acid is generally unnecessary after treating mid-Continent overhead distillates with Chlorex. Yields of 85–95% of superior quality oils are obtained by Chlorex treating Pennsylvanian lubricating stocks, residuum or overhead. Little or no clay is required to produce a satisfactory colour, whilst on bright stocks and cylinder stocks percolation yields should be nearly doubled. The finished oils will have a high resistance to sludging

and oxidation and a low Conradson carbon residue value. It is estimated that solvent extraction plants having a finished oil capacity of 7,300,000 brl. per annum have been installed or are under construction in the U.S. C. L. G.

85. Duo-Sol Plant now in Operation. Anon. *Refiner*, 1934, **13**, 369–374; C. O. Willson, *Oil & Gas J.*, 4.10.34, **33** (20), 12.—Describes the construction and operation of the first completed Duo-Sol plant of four reported as under construction. The plant consists essentially of an extraction system in which the charging stock is separated into its paraffinic and naphthenic constituents by the use of solvents which will selectively dissolve these, and a double solvent recovery system in which the solvents, propane, and selecto are recovered from the paraffinic and naphthenic oils. The quantity of each solvent used, relative to the feed, is varied independently, depending on the gravity, paraffinicity, and asphalt content of the charge and the viscosity index desired for the finished oil. Very asphaltic residues require higher solvent ratios, light distillates the lowest for a given viscosity index, whilst high viscosity indices require more solvents than lower viscosity indices.

The Duo-Sol treated oils are filtered in solution by percolation, yields averaging between 20 and 25 brl. per ton of clay, and finished by Sharples dewaxing. B. C. A.

86. Production of Lubricants from Osage Crude. Anon. *Refiner*, 1934, **13**, 395–399.—Details the processing of the crude averaging 34·1° A.P.I. gravity, for the production of lubricants. A long residuum from flash distillation is treated with about 35 lb. of sulphuric acid per barrel of oil, and the acid-treated stock neutralised with ammonia. After dilution with naphtha 50/50, the stock is filtered through clay at 100° F. Following further dilution with naphtha the stock is batch chilled to 0° F. and then transferred to a continuous chilling plant in which the mixture is cooled to — 45° F. in four stages, and centrifuged. The dewaxed mixture is stripped continuously of naphtha and light ends, and the reduced residuum batch distilled with steam. The bright stock secured is percolation filtered before blending. B. C. A.

87. Economies in Grease-making. F. E. Huggins. *Refiner*, 1934, **13**, 400–402.—Evidence is advanced to support claims made for the saving of steam and power, time, heating and cooling, and in the elimination of re-working, resulting from the use of cast-in-one-piece grease kettles the seamless construction, smooth surface, and true contour of which permit the use of positive scraping agitators, *i.e.* agitators the blades of which are adjustable and renewable and actually scrape the walls of the kettle. The blades are almost parallel with the wall, and are kept sharp by rubbing, without worn-away metal being detectable in the grease. The blades cut ahead of the agitator and do not drag against the wall, but press thereon and keep the wall clean. B. C. A.

88. Cracking of Shale Oil. Y. Khisin. *Khimiya Tverdogo Topliva*, 1930, **1** (4), 55–57.—In the experimental cracking of Kashpira shale oil the following results were obtained: Cracking temperature 580° C.; yields 30·9% gas, 51·8% tar, 9·7% coke, 7·4% losses; total unsaturates 27·4%; sp. gr. of 175° C. end point gasoline 0·904, the yield being 11%. The above results indicate that at present this process is of no commercial value. Foreign Petr. Techn.

89. Cracking and Hydrogenation of Shale Tars. M. D. Tilicheev and G. N. Seledzhiev. *Foreign Petr. Techn.*, 1934, **2** (6), 207.—Estonian and Kashpira shale tars when cracked give high yields of coke and gas and relatively low yields of gasoline high in sulphur content. Hydrogenation of these tars yields up to 70% gasoline of very low sulphur content. Nickel was used as catalyst, the reaction temperature being 450° C., pressure was 200 atm., whilst the consumption of hydrogen was about 6–7%. G. R. N.

90. Acetaldehyde from Acetylene. H. Thommen. *Chem. Z.*, 1934, **58**, 797–800.—An historical account of this industry is given, commencing with the first patent of Grünstein in 1910 in which acetylene is passed into 45% H_2SO_4 containing a small amount of HgO at 15–25° C. with agitation. Between 1914 and 1917 numerous plants were erected on the Continent. The producers of synthetic acetic acid are the chief consumers of acetaldehyde. The best methods now in use are described.

L. S.

91. Methane as a Source of Hydrogen. C. Padovani. *Chim. et Ind.*, 1934, **32**, 517.—An account is given of experiments dealing with reactions of methane present in large quantities as natural, cracking, or coke gas, in connection with its technical applications.

In a previous paper the cracking of methane was studied and the practical difficulties due to deposition of carbon were described. A more suitable method would be a homogeneous vapour-phase reaction, *e.g.* with carbon dioxide, air, or steam, with which there would be no carbon deposition. An elevated temperature (900–950° C.) is necessary, at which the reaction with CO_2 is the most rapid.

Ni and Co on a carrier prove to be durable and active catalysts notwithstanding the elevated temperatures, and suitable activators are the oxides of Al, Th, Zn, and Mg.

The cracking of methane and the water-gas reaction are equally activated by these catalysts and organic fixed S does not harm their activity. Experiments with CO_2 and with steam as an oxygen-containing agent are described:

1. As a catalyst, the carrier without the catalysing metal was tried, the conditions of temperature, rate of flow, etc., being as in the preceding experiments. The gas mixture passed through the reaction zone unaltered.

2. The use of a Ni catalyst as a carrier, together with nitrogen, resulted in the complete cracking of methane into C and H_2.

Consequently, the succession of reactions is claimed to be: (*a*) decomposition of methane by cracking, followed by (*b*) oxidation of the freshly formed carbon by the oxygen-containing gas.

The results obtained on a laboratory scale are in good agreement with the calculated equilibrium equations and with technical data. The catalyst, if carefully prepared, is free from objections.

Experiments with methane and mixtures of air and steam were carried out in order to obtain a gas mixture of CO_2 and H_2 from which the CO_2 could be easily removed. Mixtures with air were made so that the right preparation of N and H_2 for ammonium synthesis was obtained. A small amount of CO was formed, which could be reduced by using a greater excess of steam.

The process in which methane is oxidised in one stage to CO_2 is not considered to be as profitable as the 2-stage process in which it is first oxidised to CO and then to CO_2.

The same Ni catalyst was used for experiments with methane and a mixture of CO_2 and steam, the optimum temperature being 850° C. At lower temperatures the reaction with CO_2 is favoured, while at higher temperatures the reaction with steam predominates. P. C. K.

92. Prevent Accidents. J. C. Albright. *Refiner*, 1934, **13**, 375–380.—Stating that a marked reduction in accidents has been made in refineries and natural gasoline plants in the past few years through the efforts of the safety organisations and operators of equipment, the causes of accidents and methods leading to their minimisation are discussed. B. C. A.

93. Action of Hydrogen on Steel. D. V. Alekseev and V. V. Ostroumov. *Foreign Petr. Techn.*, 1934, **2**, 182.—A steel containing 0·35% C, 0·89% Mn, 0·29% Si, 0·04% P, 0·024% S, 0·19% Cr, 0·91% Ni, and 0·12% Cu, and another steel (wire) containing 0·39% C, 0·10% Si, 0·66% Mn, 0·053% S, and 0·02% P, were subjected to hydrogen pressures of 260–780 atm. at a temperature of 200–530° C. in an autoclave. The mechanical strength of the sample was determined before and after, while a microscopical examination was also made. It was found that the lowering of the mechanical properties goes parallel with decarbonisation. It is concluded that the hydrogen penetrates the steel in the first stage and causes conversion of the cementite grain into ferrite first only on the surface. A literature review is appended. G. R. N.

94. Action of Acetylene containing Cracked Gases on Copper and Brass. V. S. Zalkind and B. A. Voosi. *J. Appl. Chem. U.S.S.R.*, 1933, **6**, 677–680.—The experiments were carried out with cracked gases containing up to 1·68% acetylene at room temperature, 50° and 80° C., and under atmospheric and at 35 atm. pressure. The gas was passed for about one month at 1·1 cu. metres per day over the metals, which were then analysed for copper acetylide. Only traces of this compound were found. Foreign Petr. Techn.

95. Addition of Nitrogen to Chrome Steels. Anon. *Nat. Petr. News*, 10.10.34, **26** (41), 38.—A serious drawback to the use of high chromium steel for castings has been the coarse-grained structure of these steels. The addition of nitrogen in the form of high nitrogen ferrochrome and in the proper proportion has been found effective in reducing grain size considerably without impairing the other valuable properties of the alloy. H. G.

96. Patents on Refinery Plant. W. C. Peck. E.P. 418,065, 18.10.34. A packing for distillation columns consisting of prismatic pieces constructed to provide on two opposite ends, narrow slot-like spaces separated by thin walls and extending the whole length of the piece.

E. L. Byrne. E.P. 418,086, 18.10.34. A corrugated metal heat-exchange tube in combination with a heat radiating strip which is helically disposed about the tube so that the inwardly directed portions of the corrugations are not filled by the strip.

T. F. Linnekogel. E.P. 418,414, 24.10.34. An oil-burner for cooking ranges constructed to provide a sootless flame.

C. E. and C. Mainzer. E.P. 418,552, 26.10.34. An oil-burner in which oil unmixed with air is delivered intermittently under high pressure directly into the combustion space and atomised as it enters the latter.

E. R. Holm. E.P. 418,953, 2.11.34. A protecting surface for corrosion prevention, consisting of cellulose-lacquer or varnish. A layer of dry flake-like cellulose lacquer is applied while the penultimate coating is still adhesive.

F. S. Woidich. E.P. 419,116, 6.11.34. A fire-protection device for storage tanks. An automatic vent-valve is provided for the escape of gases under pressure together with a suction-vent valve for the admission of air. A flame-arrester common to both valves is also provided.

R. S. Laraque. E.P. 419,421, 12.11.34. A rotary pump with variable output, in which the discharge is controlled by varying the eccentricity of the two rotors.

W. G. Laird. U.S.P. 1,976,029, 9.10.34. A method for controlling the temperature of pipe-still furnaces. The oil passing through one portion of the tubes is heated by an over-ventilated combustion of fuel. The remaining oil is heated by burning additional fuel with only the excess oxygen supplied in the first heating.

E. Blanckenburg. U.S.P. 1,977,617, 23.10.34. A method of operating a plurality of hot blast stoves used for cracking processes. A given stove is heated by the combustion of fuel, and when the desired temperature has been reached, heating is discontinued and the products of combustion from another stove are passed through, thereby purging it of air. W. H. T.

A. Thielmann. D.R.P. 61,276, 20.5.32. Corrosion of metal plant is prevented by the application of a mixture of petroleum bitumen (m. p. above 60° C.) with proto-paraffins. L. S.

97. Patents on Cracking. Standard Oil Co. E.P. 418,547, 26.10.34. Oil is cracked (35% per pass without recycling) and the resultant products are separated into light oil, heavy residue, and an intermediate fraction. The latter is subjected to vapour-phase cracking.

J. C. Black. U.S.P. 1,975,071, 2.10.34. A reaction chamber fitted with a non-corrodible metal lining.

C. P. Dubbs. U.S.P. 1,975,315, 2.10.34. Oil is cracked and the cracked vapours are separated from unvaporised oil which is distilled under reduced pressure, the distillate being returned to a dephlegmating zone.

U. S. Jenkins. U.S.P. 1,975,549, 2.10.34. Oil from a vapour-separating drum is circulated through cracking tubes and back to the drum. Vapours are removed and fresh stock is continuously charged to the drum. The addition of stock is interrupted periodically to allow of the removal of oil from the drum. This removal is at such a rate as to bring about a surge-effect which removes carbon from the drum.

A. M. McAfee. U.S.P. 1,976,507, 9.10.34. Oil is heated to just below cracking temperature and mixed with 1% of aluminium chloride, the mixture being passed to a reaction chamber, where conversion takes place under pressure.

O. Behimer. U.S.P. 1,978,072, 23.10.34. A cracking plant comprising a heating coil and a series of converters.

H. P. Benner. U.S.P. 1,978,562, 30.10.34. Oil is cracked and passed to a reaction chamber. When the latter is filled with coke, the flow of oil is diverted to a second

chamber which has previously been heated to reaction temperature by means of combustion gases.

V. Nekler. U.S.P. 1,978,592, 30.10.34. Vapour phase cracking by direct contact with partly cooled combustion gases. The gas mixture is heated further by indirect heat exchange with hot combustion gases.

E. F. Nelson. U.S.P. 1,978,593, 30.10.34. A reaction chamber fitted with means for introducing a cooling medium in a stream concentric with the outlet valve control.

R. Carter. U.S.P. 1,978,984, 30.10.34. Oil is cracked and then contacted with solid hydrocarbons, vapours from both materials being removed by vacuum distillation. W. H. T.

98. Patents on Hydrogenation. South Met. Gas Co. and H. Stanier. E.P. 418,235, 22.10.34. A method of bringing about high-pressure reactions between liquids and elastic fluids. The two materials are caused to flow together through a tube of less than 2 in. internal diameter at such a velocity that turbulent flow is produced in the tube.

N. Pier and W. Simon. U.S.P. 1,975,475, 2.10.34. Desulphurisation of crude benzol by hydrogenation at elevated temperatures and pressures in the presence of a catalyst immune to sulphur poisoning.

E. Hochschwender and M. Josenhaus. U.S.P. 1,977,992, 23.10.34. Recovery of hydrogen from two gas mixtures containing different proportions of hydrocarbon gas. Part of the latter is removed from the mixture richer in hydrocarbons and the washed gas combined with the other gas mixture. The combined gases are washed with a solvent for hydrocarbon gas and returned to the hydrogenation process. W. H. T.

K. Schoenmann. D.R.P. 602,815, 9.5.26. Crude distillates from pressure-hydrogenation are mixed, without removal of phenols, with a solvent and a small amount of dilute acid. Solution and precipitate are separated, the latter having the character of fuel oil, whilst the solute contains lubricating oil.

R. Bingley. D.R.P. 60,705, 29.3.32. Hydrogenation process in which the raw materials are passed through narrow chambers the walls of which are rubbed with a powdered catalyst (silico ester). L. S.

99. Patents on Crude Oil. M. De Groote, B. Keiser, W. Groves, and A. F. Wirtel. U.S.P. 1,975,839, 9.10.34. Separation of oil–water emulsions by subjecting the emulsion to the action of a demulsifying agent consisting of a mixture prepared by mixing a relatively large quantity of anthracene oil and a relatively small quantity of oleic acid, the whole being allowed to react with sulphuric acid until water-soluble. The mixture is then washed, the waste acid separated and neutralised.

M. De Groote, W. C. Adams, B. Keiser, and W. Groves. U.S.P. 1,976,602, 9.10.34. Demulsifying agent in the process described above consisting of a substituted triricinolein in which two alcoholic OH groups have been replaced by oxalic acid residues having a carboxyl radical in the form of an acid or salt.

M. De Groote, C. H. M. Roberts. U.S.P. 1,977,048, 16.10.34, also C. H. M. Roberts. U.S.P. 1,977,089, 16.10.34. Demulsifying agent being a mixed ester of the type $DA\,(CO_2H)_d\,R(OH)_m$ in which D is an oleic acid residue, A is an oxalic or succinic acid residue, R is a glycerol residue, m represents the numeral zero, one or more, and d represents the numeral zero or one.

C. H. M. Roberts. U.S.P. 1,977,146, 16.10.34. Demulsifying agent consisting of a substituted polyhydric alcoholic substance derived from castor oil, phthalic anhydride, and glycerol in chemical combination and partly saponified with ammonia and diluted with denatured alcohol.

C. H. M. Roberts. U.S.P. 1,978,227, 23.10.34. Demulsifying agent being a chemical compound consisting of at least one phthalic acid residue and at least one castor oil residue in admixture with SO_2 extract.

R. B. Chillas, Jr. U.S.P. 1,978,414, 30.10.34. Separation of component liquids from a mixture of liquids and applicable to the distillation of a crude oil. The latter is heated in a pipe still, and the liquid and vapour are led to the lower portion of a fractionating column (inlet temperature 800° F.). The vapours rise and meet a descending reflux liquid, which collects as a series of pools in the column each at a higher temperature than the one next above. W. S. E. C.

100. Patents on Gas. E. H. Berkhuijsen. E.P. 418,050, 17.10.34. Apparatus for scrubbing gases comprising a plurality of scrubbing chambers, the absorbing liquid being led in direct contact with the gas. The latter is supplied to each chamber successively through passage-ways so arranged that the gas flows through the chambers in a radial direction. At different points of the periphery of the chambers, liquid atomisers are provided for supplying the liquid in a finely divided state.

O. C. Brewster. U.S.P. 1,976,212, 9.10.34. A stabilising and absorption system comprising a column having absorption, stripping, and intermediate sections. Means are provided for introducing the feed into the intermediate section and for withdrawing the ultimate product at an intermediate point in the stripper section. Absorber oil is withdrawn from the bottom of the stripping section and a return line is provided for recycling the absorber oil to the top of the absorption section.

M. P. Yonker. U.S.P. 1,976,469, 9.10.34. Conversion of gaseous hydrocarbons into liquid by treatment at 750° and 1250° F. and 500–3500 lb. per sq. in. pressure in the liquid phase.

C. R. Wagner. U.S.P. 1,976,591, 9.10.34. Pyrolysis of natural gas by heat treatment at 1250–1350° C. at 30 lb. per sq. in. The gaseous olefinic portion of the product is subjected to a pressure of 200 lb. per sq. in., liquefied material is removed, and the gas subjected to pyrolysis at 500–950° F. and 1000 lb. per sq. in. pressure. Unsaturated low-boiling oils are separated from the remaining fixed gas.

A. E. Dunstan and R. V. Wheeler. U.S.P. 1,976, 717, 16.10.34. A thermal process for the conversion of gaseous paraffins into aromatics, heat treatment being carried out at 650–950° C. at a controlled velocity.

P. M. Raigorodsky. U.S.P. 1,977,087, 16.10.34. A method of stabilising pressure distillate. A light fraction is removed by distillation, and the uncondensed vapours are subjected to compression and cooling in a plurality of stages at progressively increasing pressures. The condensates are blended and rectified in a second zone.

W. H. T.

101. Patents on Motor Spirit. M. B. Mitchell and L. Bentley. E.P. 417,946, 16.10.34. A motor fuel comprising kerosine (99%), ether (0·5%), and camphor (0·5%).

Gray Processes Corpn. E.P. 418,472, 25.10.34. Refining a liquid hydrogenated product from coal. The light fraction of high gum content and poor stability is removed and the residue treated in the vapour phase with an agent capable of polymerising the gum-forming components.

I.G. Farbenind. A.-G. E.P. 418,926, 2.11.34. Improvement of low-quality benzine by hydrogenation followed by heat treatment.

Int. Hydn. Pats. Co. Ltd. E.P. 418,941, 2.11.34. Improvement of motor-benzol which tends to form a pitchy residue. The material is blended with a refined spirit of the same boiling range, and the mixture subjected to controlled hydrogenation.

C. W. Stratford. U.S.P. 1,975,987, 9.10.34. Removal of sulphur compounds from motor fuel by continuous counter-current treatment with acid followed by centrifugal removal of the tar. The material is finally subjected to a continuous doctor-treatment.

F. A. Apgar. U.S.P. 1,976,000, 9.10.34. Apparatus for the vapour phase refining of light distillates. It consists of a tower divided into compartments separated by foraminous partitions, the latter being adapted to retain an adsorptive catalyst.

C. Ellis. U.S.P. 1,976,696, 9.10.34. A cracked motor spirit of petroleum origin comprising products of gentle oxidation between 250° and 475° F.

E. C. Higgins. U.S.P. 1,977,631, 23.10.34. A process for altering the mercaptans in motor fuels which comprises adding elemental sulphur and passing the mixture through a mass of brucite.

W. N. Davis. U.S.P. 1,977,717, 23.10.34. Refining of motor fuel by multi-stage acid treatment, successive stages using stronger acid. After each stage, the mixture is cooled in order to permit of part of the sulphur being selectively removed by the acid.

W. H. T.

102. Patents on Lubricating Oil. Pope & Co. Gesell. mit beschränkter Haftung. E.P. 418,204, 15.10.34. Process for working up acid sludge from the refining of petroleum by mixing it first with an excess of slaked lime or chalk in the presence of water and heating to the b. p. of water. The water is separated mechanically before introducing the mixture and the oil by means of an atomising nozzle into a retort from which air is excluded. The hydrocarbons are subjected to a cracking process.

The diameter of the retort and the density of the drops are regulated by introducing inert gases or vapours.

J. Stone & Co., Ltd., and A. W. Empson. E.P. 418,518, 26.10.34. Apparatus for centrifugal treatment of oils or oily liquids requiring refining, in particular lubricating oils containing colloidal carbon. A small predetermined quantity of water is added to the centrifugal apparatus by means of a nozzle fitted with a fine orifice opening axially within the oil-feed duct, and a constant delivery pressure is maintained at the orifice. If the oil-feed duct depends concentrically within a central admission chamber, a small tube is provided depending concentrically within the oil-duct, having a fine orifice at its lower end.

Standard Oil Development Co., E. V. Murphree, and E. D. Reeves. E.P. 418,939, 2.11.34. Separation of wax from solid waxy hydrocarbons and hydrocarbon oil, provided the solid and liquid have different densities. The mixture is fed against one side of a filtration membrane while subjected to the action of a centrifugal force, so that the filtration pressure exerted on the wax is sufficient to build up a filter cake on the membrane and the filter pressure exerted on the oil is greater than that on the solid wax. The oily filtrate is withdrawn from the other side of the membrane.

T. G. Ferguson and B. H. Hovey. E.P. 419,007, 5.11.34. Filtration of lubricating oil in a tank containing four compartments through which the oil flows successively by gravity or under pressure. The first compartment contains the means for heating and is a combined heating and settling compartment. The second contains one or more screen devices through which the oil flows on its way to the third and fourth compartments, from which the filtered clean oil is supplied to the journals of the machine. The fourth compartment, which contains clean oil, is arranged to receive filtered oil from opposite sides of the filtration compartment.

P. C. Stroud and R. L. Brace. U.S.P. 1,975,594, 2.10.34. A process and apparatus are described for reconditioning used crankcase oils. One receptacle receives contaminated oil and another contains a treating solution (*e.g.* tribasic sodium phosphate and water). The water is led continuously to the bottom of receptacle 1 to the bottom of receptacle 2, and the treated oil is delivered to an evaporator to remove volatile fluids by heat. The heated oil is then passed with the refining solution through a strainer to remove carbon or coke. Receptacle is specially constructed; it contains a plurality of louvers arranged in staggered relation, and each louver is disposed at an acute angle to the horizontal and open at its upper end. The contaminated oil is led into a receptacle below the louver and the oil is caused to flow in a continuous thin film along the lower surface of the louver.

A. Lazaar. U.S.P. 1,976,177, 9.10.34. Stability of lubricating oils is increased by subjecting the oil at 350° F. to oxygen so as to oxidise part of the distillate and vaporise undesirable products in the presence of adsorbent clay. The heat and oxygen are stopped, and steam is added to reduce the temperature to 275° F. and remove undesirable vaporised products, which are removed together with the clay.

H. V. Atwell. U.S.P. 1,976,535, 9.10.34. Wax is separated from lubricating oil by means of liquefied propane which is added until the solution contains at least two and a half volumes of liquefied propane to one volume of oil. The solution is cooled in a chill chamber to solidify the wax at a rate of 3°/min. by evaporation of propane. The wax is separated mechanically from the diluted oil and the propane evaporated off for re-use.

J. H. Diggs and J. M. Page, Jr. U.S.P. 1,976,544, 9.10.34. Treatment of lubricating oils to resist oxidation and sludging. The oil is heated and agitated with a solvent containing acetone and a chlorinated aliphatic ether, and the mixture is cooled until the oil separates into a highly paraffinic fraction and a sludge. The former is treated with 80–98% sulphuric acid in the proportion of 1–1½ lb. of acid/gallon of oil.

R. N. Giles. U.S.P. 1,977,054, 16.10.34. Dewaxing of lubricating oils using liquefied propane.

W. J. McGill and C. E. Adams. U.S.P. 1,977,055, 16.10.34. Dewaxing of lubricating oils using liquefied propane.

P. F. Carlisle. U.S.P. 1,978,010, 23.10.34. Wax extraction of lubricating oil by adding methylene chloride to the oil–wax mixture, cooling below 32° F. to precipitate the wax, removing the wax, and separating the methylene chloride from the oil.

G. A. Beiswenger. U.S.P. 1,978,361, 23.10.34. Treatment of heavy residues such as reduced crudes, tars, etc. to produce lubricating oils by passing the crude through

an elongated narrow heating zone into an enlarged distillation zone under vacuum. The light lubricating oil fraction is removed and the bottoms and light hydrocarbon solvent (pentane) are removed separately, the lighter hydrocarbons being passed into a zone for asphalt removal under pressure. An asphaltic layer and a deasphaltised bottoms layer in light hydrocarbon solution are now obtained. The viscous lubricating oil is admixed with deasphaltised bottoms solution, the mixture chilled and allowed to settle in a dewaxing zone. Wax separates, and the light hydrocarbon solvent is removed from the dewaxed heavy lubricating oil solution.

I. Rosenberg. U.S.P. 1,979,232, 30.10.34. Removal of sulphur dioxide in the Edeleanu process. The raffinate and extract are passed through two evaporation systems, one in which the temperature is 200–250° F. under condenser pressure and the second at 300° F. at atmospheric pressure. The vapours from both stages are passed through rectification zones in which liquid sulphur dioxide is employed as an end reflux medium. W. S. E. C.

I.G. Farbenindustrie. Dutch P. 55,136, 12.1.31. Production of lubricating oils by passing the crude material into a distillation apparatus, in which it is distilled with hydrogen under pressure in a column before pressure-hydrogenation without catalysts. The distillation residue is separated out and can be treated separately.

Standard Oil Development Co. Linden. Dutch P. 63,597, 16.12.32. Lowering of the pour point of lubricating oils by means of a product obtained by polymerisation and condensation of eventually chlorinated paraffinic hydrocarbons or alkenes with aluminium chloride. It is purified from inactive compounds with a mol. wt. of 1200 by extraction with a liquid solvent. P. C. K.

103. Patents on Asphalt. S. Tijmstra. U.S.P. 1,975,563, 2.10.34. A continuous process for blowing residues to produce asphalts.

L. Wittenberg. U.S.P. 1,976,908, 16.10.34. Production of pitch from coal-tar by distillation to a point where substantial decomposition and a desired amount of free carbon formation take place. A portion of the distillate is mixed with the residue and the mixture distilled until it has the desired melting-point and free carbon content.

E. Rouault, E.P. 419,358, 5.11.34. Preparation of stable aqueous emulsions having as a base, tar and pitch from wood, shale, coal, bitumen, etc. The dispersing medium is an alkaline phenate and " amylaceous " matter mixed with a soap. W. H. T.

104. Patents on Special Products. Bat. Petm. Mij. E.P. 418,043, 17.10.34. Chlorination of hydrocarbons for the production of unsaturated monochlorides from tertiary olefines. The hydrocarbons are atomised in the liquid state by means of a stream of chlorine which simultaneously injects the atomised oil into a chamber.

I.C.I., C. Dunbar and S. H. Oakeshott. E.P. 419,154, 5.11.34. Preparation of wetting agents for increasing the wetting properties of caustic lyes used in mercerising. Instead of the phenols, fatty acids, etc., specified in E.P. 385,977, phenolic fractions of low-temperature tar are used together with small proportions of pine oil or terpineol.

V. Mehner and S. F. Rostler. E.P. 419,372, 12.11.34. Organic substances are recovered from acid sludge by neutralisation followed by vacuum distillation. W. H. T.

Deutsche Gold u. Silber-stalt. D.R.P. 599,631, 22.8.28. Acetylene addition products are prepared by the aid of silicic acid impregnated with metal salts of strong O-containing acids as catalysts.

Oranienburger Chem. Fabrik. D.R.P. 599,933, 3.5.28. High molecular sulphonic acids and their salts are produced by condensing neutral fats, fatty acids, resin, or naphthenic acids with aromatics and low molecular fatty acid anhydrides.

Gutehoffnungshütte. D.R.P. 600,040, 29.4.29. Preparation of acetaldehyde by oxidation from methane and carbonic acid. The charging stock is passed over high-tension, high-frequency electrical field.

Ges. f. Teerverwertung. D.R.P. 601,314, 14.8.32. Tar phenols are purified by mixing alkaline solutions thereof with water-insoluble aliphatic or aromatic alcohols. The excess of solvent is removed, water is evaporated, and the product precipitated and distilled. L. S.

Class 700. Utilisation.

105. Influence of Lead Tetraethyl on the Combination of Hydrogen and Oxygen. H. G. Tanner. *J.A.C.S.*, 1934, **56**, 2250–2252.—The explosion of electrolytic gas, total pressure 40–120 mm., in a vessel surrounded by liquid air, leads to the formation of about 0·2% of hydrogen peroxide, in the water which results. The addition of traces of T.E.L. raises the concentration of H_2O_2 to 0·9–1·2%, and also reduces the noise of the explosion. To explain the above observations, which do not appear quite compatible with modern detonation theories, the following is suggested. The passage of the spark through electrolytic gas leads at first to atoms of hydrogen, oxygen, electrons, and ions. Collisions of these with each other and with molecules of hydrogen and oxygen give a reaction sphere which generates "active," and unstable, molecular, and atomic species. These are projected through the gas phase with high velocity, more particularly the hydrogen atoms. These generate a second sphere of activity, forming, *e.g.* ozone, hydroxyl, hydrogen peroxide, water molecules, etc. It is suggested that molecules of T.E.L. interrupt the passage of the hydrogen atoms, so minimising the secondary reactions, and hence giving quieter combustion. At the same time, with less atomic hydrogen available, reactions such as $H + H_2O_2 \longrightarrow HO_2 + H_2$ or $H + H_2O_2 \longrightarrow H_2O + OH$ are less likely to occur. Hence more intermediate peroxide is recovered. W. E. J. B.

106. Gaseous Specific Heats and Internal-combustion Engine Efficiencies. W. T. David. *Engineer*, 1934, **158**, 476.—The specific heats of the gases which constitute the products of combustion of an internal-combustion engine have been calculated from the Planck–Einstein equation by Nernst and Wohl, and Johnstone and Walker. The calculated values are compared with those determined experimentally by the author, and with the values given by Pier and Bjerrum, and Partington and Shilling. The author's values give good agreement with the theory, the others do not. The possible reason for the inaccuracy of the values of Partington and Shilling is the variation in the determined value of the specific heat with the frequency of sound, if the sound method is used.

The author's experiments were made using the explosion method. As large a vessel was used as possible, and the greatest possible care was taken in applying heat loss corrections. Even with the large vessel used (18-in. diam.) there is still some incomplete combustion. The amount of this was calculated for each experiment using the various systems of specific heats. The percentage of energy unaccounted for varied from 0·3 to 13·5 when Partington and Shilling's values were used, whereas the theoretically calculated values gave a constant figure of 2·5%. This is to be regarded as strong confirmation of the calculated specific heats.

The use of the new specific heats, which are higher than the previously accepted values, does not give any difficulty when calculating the ideal efficiency of a slow-speed engine. But in the case of a high-speed engine the difference between the ideal and actual efficiencies is not great enough to allow for the known losses such as heat loss during the explosion–expansion stroke. It appears that if all losses could be suppressed the actual efficiencies would be higher than the ideal, which suggests that the calculated specific heats are too high. It is suggested that in a high-speed engine the explosion process is so rapid that the molecules of the diluent gases do not have time to attain their equilibrium share of vibratory energy, and so behave as though they had lower specific heats. If this is so, then the indicated thermal efficiency should increase with speed. P. D.

107. Observations of Flame in an Engine. F. Marvin, Jr. *J.S.A.E.*, 1934, **35**, 391–398.—This paper describes a series of experiments carried out at the Bureau of Standards, under sponsorship of the N.A.C.A., in order to study flame propagation and radiation from behind the flame front in an internal-combustion engine. For this purpose a side valve L head single-cylinder engine was equipped with a special head containing thirty windows. By suitable arrangement of mirrors, lenses, and a stroboscope fitted with phase-changing device, it was possible to look down vertically through each window without altering the eye position. Alternatively, a camera could be placed at the eyepiece and photographs taken at various settings, the stroboscope acting as a high-speed shutter for the camera, each exposure taking about 30 sec. The progress of the flame front at any degree of crank angle could thus be observed from

the position of the windows illuminated. Composite diagrams made up from series of such photographs show that the flame progresses in patterns roughly concentric about the point or points of ignition. "Reaction velocity" is defined as the rate at which the flame front progresses into the unburnt gases, and "gas velocity" merely expresses gas motion and involves no burning. It has been found that the former varies greatly for different fuels, is at a maximum near the equivalent mixture for any given fuel, and is usually reduced by the presence of inert gases. Composite diagrams are given showing the effect of varying the position of the spark plug, and double ignition. Generally speaking, flame velocities are shown to be at a maximum at roughly the middle of inflammation relative to crank angle and at a minimum at the beginning and end. More intensive investigation of conditions in and behind the flame front was carried out by fitting fluorite discs transparent to the infra-red in place of two of the windows, and the beam from these was projected by suitable reflectors through the stroboscope discs on to a highly sensitive single-junction, antimony–bismuth vacuum thermocouple. Filters for determining spectral energy distribution were placed over the windows. It was found that the infra-red radiation which is probably almost exclusively emitted from the combustion products, water, and carbon dioxide, continued in a normal explosion for about 30° of crank angle after the beginning of the flame at a given point. During fuel knock, flame appeared earlier in the region remote from the spark plug, and the infra-red radiation reaches a maximum much earlier after the appearance of the flame, indicating more rapid reaction following inflammation, than in the normal explosion. C. H. S.

108. High-Power Spark-Ignition Fuel-Injection Engine. T. Dillstrom. *J.S.A.E.*, 1934, **35**, 431–438.—A descriptive article dealing with the Hesselman Engine. This engine was recently described in the *J.S.A.E.* by Pope, the Research Engineer of the Waukesha Motor Co., the American licencees. (See Abstract No. 1648/1934.)
C. H. S.

109. Ice Formation in Aircraft-Engine Carburettors. H. H. Allen, G. C. Rodgers, and D. C. Brooks. *J.S.A.E.*, 1934, **35**, 417–429.—Since ice cannot form in the carburettor unless the mixture temperature is below both the dew-point and the freezing-point, the factors involved are: (*a*) volatility and heat of vaporisation of the fuel; (*b*) mixture ratio; (*c*) humidity, pressure, and temperature of the intake air; (*d*) heat transfer between the carburettor and its surroundings. Small-scale tests were made with seven fuels in a special apparatus which consists essentially of two parallel pipes through which air is inducted from a common source. In the upper pipe is a psychrometer and in the lower a carburettor venturi, in the throat of which is a jet supplied from a metering orifice. Temperatures and pressures at various points are indicated by thermocouples and manometers, respectively. Large-scale tests were made with a Curtiss D-12 engine. A number of relationships are plotted and an attempt has been made to correlate the temperature drop due to evaporation of a fuel at the venturi (on which the ice-forming tendency depends) with the A.S.T.M. distillation. The 50% temperature is shown to be a more suitable index than the sum of the 10, 50, and 90% points (specified by the U.S. Army). Other conclusions are that freezing is probable at any humidity when the venturi temperature is 4–5° C. below the dew-point. The venturi temperature in an unheated carburettor can be predicted when the mixture ratio supplied and the distillation characteristics are known. The danger of ice formation under specified atmospheric conditions tends to increase with increasing richness of the mixture and with increasing volatility of the fuel. The direct application of heat to control venturi temperature is more effective in preventing ice formation than intake air heating.

In appendices the methods of calculating (1) the relation between intake and mixture temperatures when ice formation occurs, and (2) equilibrium–air distillation curves for a series of supplied mixture ratios, are given, and in a third appendix border conditions are defined for an engine operating near the danger zone. C. C.

110. Butane as an Automotive Fuel. D. P. Barnard. *J.S.A.E.*, 1934, **35**, 399–401.—The possibilities of using butane as an automotive fuel are discussed. Distribution presents some difficulty, since this product must be handled and stored under pressure. Although the knock-rating is high, since the sp. gr. is so low (0·58), the volumetric fuel economy is low. If the equipment is specially designed for butane, the weight of the extra tankage required would more than counterbalance the lighter weight of the

fuel itself. The fire risk is greater than with gasoline. It is concluded that butane cannot be economically adapted for use in small automotive units, but it is suggested that an engine to use this fuel could be developed of, say, 800–1000 h.p. for railway service. Production figures are given for butane showing that the total available supplies would not be sufficient for more than 10% of the registered commercial vehicles in U.S. in 1933. C. C.

111. Experiences with Stable Bitumen Emulsions. — Henne. *Bitumen*, 1934, **8**, 197–200.—A short comparison is made between old and new methods of road-making with stable bitumen emulsions.

A formula is given to calculate the amount of emulsion required to give a desired bitumen content in the finished road. J. L. T.

112. Application of Pitch for Building Roads. M. V. Goftman and B. S. Shteingardt. *Khimiya Tverdogo Topliva*, 1930, **1** (3), 23–27.—The experiments were carried out with coal tar pitch and with anthracene oil. Both were blown with air separately and in mixtures at various temperatures and for various periods. It was found that a mixture of pitch and anthracene oil blown at a temperature not exceeding 200° C. yields a product of satisfactory quality. The product should have a softening point of 32–35° C. (Kraemer–Sarnow). Foreign Petr. Techn.

113. Relation between Refining of Motor Oils and their Performance. H. Ramser and H. Krekeler. *Angew. Chem.*, 1934, **47**, 765–768.—A report dealing with practical experiments with a series of refined motor oils. Oils refined by liquid SO_2 or by SO_2–benzole are superior to those refined by sulphuric acid. Mixed-base oils yield the best quality products by SO_2 extraction. There is no connection between consumption and carbon formation in motors and the degree of refining. L. S.

114. Crude Oil as a Raw Material for Synthetic Tanning Substances. Anon. *Vestnik Kozhevennoi Prom. Torgovli*, 1928, **7**, 213–214.—A short notice on A. M. Nastyukov's "formolites" and "desoxines" produced from petroleum hydrocarbons, which are condensed with formaldehyde and cellulose, respectively. These substances were prepared from a non-lubricating crude oil, which on treatment yielded about 40% of a lubricating oil. Tanning experiments showed a tanning factor of 28·92%, an ash content of the leather amounting to 6·92%, and a content in water-soluble substances of 8·73%. Foreign Petr. Techn.

BOOK REVIEWS AND BOOKS RECEIVED.

Reviews.

THE TESTING OF BITUMINOUS MIXTURES. D. C. Broome. Pp. 194. 1934. Edward Arnold & Co., London. 15*s.* 0*d.*

This volume, which, as pointed out in the preface, is designed as a laboratory manual for the use of those called upon to carry out tests on bituminous road and building materials and their constituents, will be welcomed as a useful guide to the procedure to be adopted in the examination of such materials.

The manual is divided into two sections, the first being devoted to tests on the constituent materials and the second to tests on the finished mixtures (the latter section including a chapter on the testing of roofing felts), and is completed by a number of useful tables, bibliography, and subject and author index.

The book as a whole is well written and informative, but it is to be regretted that the author has not dealt more fully with some of the methods of test nor indicated the limitations of others, whilst in some cases the method of procedure is rather loosely described and a number of inaccuracies have been allowed to find space in the first section.

Chapter 1 deals with the general physical characteristics of bitumens, tars, and oils, and here some of the formulæ for calculation and conversion of specific gravity would appear to require further explanation.

In the chapter on "Tests for Consistency," the various forms of apparatus used for the determination of viscosity, penetration, etc., are discussed and descriptions given of an automatic penetrometer and a falling sphere viscometer so designed as to permit of its use with opaque materials; this chapter also includes useful viscosity conversion formulæ. It should be noted in connection with the description of the Saybolt viscometers that the dimensions of the jet of both instruments as given by the author are incorrect.

Softening-point, brittle-point, flash-point, and volatility are dealt with under the ambiguous heading of "Heat Tests," and it is stated that in the Hoepfner and Metzger method for the determination of brittle-point these workers propose that the usual standard needle should be employed with a load of 100 grm. applied for 5 secs. Actually, however, a special type of penetrometer is used with a needle 0·5 mm. in diameter, the load being 450 gm., which is applied for 60 secs.

Furthermore, the procedure described for determination of open flash-point is not in complete uniformity with the method laid down in *Standard Methods of Testing Petroleum and its Products*, whilst the I.P.T. volatility test is said to consist of two parts: (*a*) Noting the loss in weight of a 50-gm. sample heated in a hot air oven at 220° F. for 5 hrs., (*b*) noting the further loss in weight of the sample for a further 5 hrs. at 325° F. This procedure is, of course, not correct, the standard method specifying the latter temperature only. Dimensions are also given for the containers to be used in the above test, the containers for emulsions and dressings being slightly greater in diameter but of less depth than those for oils and bitumens. The standard method does not specify the size of container to be used for emulsions, since the test is not intended to be applied to emulsions, but in the reviewer's opinion containers of the above dimensions would give considerable trouble when used for emulsion, owing to foaming of the sample.

In the chapter on "Chemical Tests" the author includes the Marcusson method for separation of bitumen into various groups by means of different solvents; the procedure described appears to be simple and straightforward, but in fact it is by no means simple, and in many cases is quite impossible to carry out, whilst the results obtained are very much open to question.

These remarks apply equally to the method for determination of saponification value given later. The chapter also includes a useful method for estimation of sulphur, for use when a bomb is not available.

The short chapter on "Electrical Tests" would perhaps have been better confined to brief definitions of the properties concerned. Space could then have been found for a note on resistivity. In the measurement of dielectric strength, when the voltage is maintained at a specified figure for 1 min., it is not the usual practice to note if any

measurable current passes, whilst the note on "Power Factor" gives no indication of the meaning of this term. In a perfect condenser the wattless current leads by 90° and not by 180°, whilst the variation of power factor with temperature is in general more important than the variation with frequency, and in any case it is scarcely practicable as a general test to measure the power factor using an alternating current of 5·0 cycles. Possibly, however, the latter figure is a misprint for 50 cycles.

It is evident from the chapter on "Emulsions" that the author has had little experience in the testing of these materials, for although his remarks on the preliminary examination are sound common-sense, some of the tests described are open to criticism. Thus in the determination of water content it is not usual to draw off a portion of the water during the test, as this has the effect of reducing the concentration of the alkali solution added to enable a clear readable meniscus to be obtained. The method for recovery of bitumen in which the emulsion is heated in a ladle at 250° F. would be expected to result in considerable hardening of the bitumen owing to the very prolonged heating required to drive off the water, besides being a very tedious and time-consuming operation. The tests for miscibility with water are of very limited application, being of value only in so far as they may be applied to very stable emulsions which it may be desired to dilute prior to use. Normal surface dressing and grouting emulsions will invariably show coagulation of binder when subjected to these tests.

The filter-paper test for rate of break will give an indication of the behaviour of an emulsion under the action of capillary forces, but the latter are as a rule of little importance in the breaking of emulsion as compared with other factors such as temperature, wind velocity, humidity, etc. The other method for determination of rate of break which the author attributes to Kirschbraun is identical with that described as "a method popular in some English laboratories," and was in fact first put forward and developed by the Technical Committee of the Road Emulsion and Cold Bituminous Roads Association.

Section 1 concludes with chapters on "Physical and Chemical Tests on Aggregates," and the former will be particularly valuable in view of the scarcity of literature on this subject. The tests include a rather interesting new method for determining the particle size and size distribution of mineral fillers. This consists in measuring the intensity of light passing through a suspension of the filler contained in a settling tank. The apparatus is described as a photo-electric turbidimeter.

In Section 2 methods of examination of finished mixtures include such tests as water, voids and soluble bitumen determinations, and, in connection with the latter, a method depending on the measurement of the light transmitted through a bituminous solution is described.

Mechanical tests of bituminous mixtures have received much attention of late, and the chapter devoted to such tests will perhaps be of greater interest to many than the chapter dealing with tests which are better known, the author having dealt with this subject in a very competent and interesting manner. Similarly, the chapter on "Roofing Felts" by R. O. Child will be of great value, since, as is pointed out by Mr. Broome in the preface, the subject is one upon which there appears to be a complete absence of English literature. The methods described include tests for fibre composition, tensile strength, pliability, weathering and ageing, etc.

In conclusion, it should perhaps be pointed out that criticism has been made in a number of cases of details of the methods of test, as it is felt that in a laboratory manual accuracy in detail is very important. In spite of this, however, the book represents a very praiseworthy attempt to summarise the various methods employed in the testing of bituminous mixtures and their constituents. A. OSBORN.

THE INTERNAL-COMBUSTION ENGINE. Vol. 2. THE AERO ENGINE. D. R. Pye. Pp. 398. 1934. Oxford University Press, London. 21*s.* 0*d.* net.

This book is an excellent sequel to the first volume, and is written in the author's characteristically logical manner. More specialised than the previous work, its appeal is mainly to those interested in the behaviour of aero engines or other internal-combustion engines of high duty. Many text-books of this description rely on a mass of experimental data from which more or less empirical formulæ are deduced; others deal mainly with first principles and fail to connect these with practical results. Mr. Pye combines the two, and every section aims at providing a rational foundation for design together with examples which illustrate how far allowances are necessary to

meet constructional and other requirements of the sort not subject to theoretical treatment, and which can only be deduced from current practice.

After a chapter by Mr. Farren on "The Aeroplane and its Power Plant," in which are set out the principles of flight as far as they need to be understood in relation to the power unit, the author deals with the limits of performance of the engine in relation to size, compression ratio, charge temperature, supercharge, and detonation. This is followed by an examination of piston and valve design in relation to temperatures and heat flow, and then by a study of the problem of lubrication with particular reference to aero engine conditions.

The theory of heat transfer is applied to cooling of engine cylinders both by air and by liquids, and the essentials of carburettor design are also explained.

Supercharging is dealt with in relation to various possible types of blower, and experimental characteristics are quoted.

The two-stroke cycle engine is examined, and the claims of the Diesel engine are examined with reference to this cycle.

The book concludes with chapters on the effect of altitude on output and the influence on economy of such factors as cylinder temperature, specific power, mixture strength, and supercharge.

No attempt is made to deal with the special problems connected with the mechanical design of the moving parts or of any part of the machine separable from the heat cycle.

The chapter on "Lubrication" is one which may need revision at a relatively early date in view of current researches which are exploring the possibility of combining high lubricating properties with extreme stability to high temperature, and it might be pointed out that Hardy's work on the boundary lubrication values for pure hydrocarbons cannot be applied to even the nearest approach available from natural mineral oil sources to the pure hydrocarbon types he examined. Thus, while Hardy found that a pure normal paraffin had a poor boundary coefficient, the behaviour of a paraffinic lubricant is such that it must contain a sufficient, though perhaps small, quantity of material of high lubricating value which makes it equal in this respect to oils of types apparently superior if judged by Hardy's standards. Further, the paraffinic class of oil, as mentioned by the author, has a high-temperature stability factor, generally greatly in excess of that of oils from other sources.

With regard to the breakdown of the lubricant on the cylinder wall, no mention is made of the possible effect of dissolved air as a major source of the oxygen attack which leads to breakdown.

The book can be thoroughly recommended to the serious student, and also to the designer who prefers to work from sound principles rather than by expensive, and often abortive, trial and error experimental methods unsupported by rational study of the factors involved.

R. STANSFIELD.

Books Received.

British Standards Institution:

B.S.S. 324—1934. Translucent (Diffusing) Glassware Illumination Fittings for Interior Lighting.

B.S.S. 364—1934. Neck and Flange Dimensions of Illumination Glassware and Carriers.

B.S.S. 562—1934. Reversible Connectors for Portable Electrical Appliances.

B.S.S. 581—1934. Electrically-driven Point-operating Machines for Railways.

B.S.S. 682—1934. Asbestos Cement Soil, Waste and Ventillating Pipes and Fittings.

B.S.S. 583—1934. Wooden Gates.

B.S.S. 584—1934. Wood Mouldings.

B.S.S. 585—1934. Wooden Stairs.

ČESKOSLOVENSKÁ NORMALISAČNÍ SPOLEČNOST. ČSN 1156—1934. SCHMIERÖLE REINE MINERALÖLE EINTEILUNG, EIGENSCHAFTEN UND PRÜFUNG.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH: REPORT OF THE FUEL RESEARCH BOARD FOR THE YEAR ENDED 31ST MARCH, 1934. 178 pp. 8vo. 1934, H.M. Stationery Office, London. 3*s.* net.

Includes the Report of the Director of Fuel Research, which deals with investigations carried out on oil from coal and from tar, the hydrogenation of coal, the production of lubricants from coal products, and the possibility of obtaining motor spirit from rubber.

GAILLARD, JOHN. INDUSTRIAL STANDARDIZATION: ITS PRINCIPLES AND APPLICATION. 123 pp. 8vo. 1934, H. W. Wilson Co., New York. $2.

The evolution of standardization is reviewed and the essential functions of industrial co-ordination are discussed. The practical application of standardization to industrial concerns is considered and the importance of preventing standards from hampering progress is stressed.

Japanese Engineering Standards Committee:

JES 173. Petroleum Products.

Standard specifications are given for petroleum products under three classes: (1) Fuel Oils; (2) Lubricating Oils; (3) Materials for Industrial Purposes.

The Fuel Oils include Aviation Gasoline, Motor Gasoline, Illuminating Oil, Gas Oil, and Diesel Engine Fuel Oil, and the Lubricating Oils are specified under various types, including Petrolatum. Under Materials for Industrial Purposes are given details of Gasolines for use as solvents and paint thinners, Liquid Paraffin for toilet articles, Solid Paraffin, and three grades of Asphalt.

JES 174. Methods of Testing Petroleum Products.

The methods of test given in this specification are those necessary to meet the requirements of Specification No. 173. In general they follow the lines of the standard tests of the I.P.T. and of the A.S.T.M.

PENNSYLVANIA STATE COLLEGE SCHOOL OF ENGINEERING. TECH. BULL. 20. PROCEEDINGS OF THE EIGHTH OIL POWER CONFERENCE, 1934. 143 pp. 8vo. 1934, Pennsylvania State Coll., State College, Pa. 75c.

This includes a number of papers on Diesel engine fuel pumps, cylinders, piston ring wear, fuel testing, oil spray penetration, together with reports of the discussions.

SCHMANDT, DR.PHIL. WILFRED. DIE ZOLLBEHANDLUNG VON FETTEN UND FETTEN OELEN VON WACHSEN, HARZEN. 75 pp. 8vo. 1934, K. Rietz, Berlin. Rm. 2.

TRINIDAD AND TOBAGO. ANNUAL REPORT 1933. Colonial Report No. 1679. 54 pp. 1 map. 1934, H.M. Stationery Office, London. 2*s.* net.

Annual report on the social and economic progress of the Islands of Trinidad and Tobago during 1933.

U.S. Bureau of Mines.

CARBON BLACK IN 1934. By G. R. Hopkins and H. Backus. 9 pp. 8vo. 1934, Supt. of Documents, Washington, D.C. 5c.

Details are given of the production of carbon black from natural gas in the U.S.A. for the year 1933.

U.S. Bureau of Mines Information Circulars:

I.C. 6805. THE EXPLOSION AND FIRE HAZARDS OF HYDROCARBON–CARBON TETRACHLORIDE MIXTURES. By G. W. Jones and R. E. Kennedy.

It is shown that to eliminate fire and explosion hazards of hydrocarbons ranging from hexane to octane the final mixtures must contain at least 70 per cent. by vol. of CCl_4. Gasoline and naphtha also require 70 per cent. by vol. of CCl_4 in the final mixture, and pentane–CCl_4 mixtures must contain at least 80 per cent. to prevent burning in an open vessel.

I.C. 6808. NATURAL-GASOLINE PLANTS IN THE UNITED STATES, JANUARY 1, 1934. By G. R. Hopkins and E. M. Seeley.

This contains details regarding the location and daily capacity of natural-gasoline plants in the U.S.A. on January 1st, 1934. The type of plant is also indicated and whether it is in operation or shut down.

U.S. Bureau of Mines Reports of Investigations :

R.I. 3253. ANALYSES OF CRUDE OILS FROM SOME FIELDS OF SOUTHERN LOUISIANA. By A. J. Kraemer and E. L. Garton.

Detailed analyses are given of twenty-six representative crude oils from various producing formations of southern Louisiana. In each case distillations are given, together with the properties of the fractions, and a summary of the commercial products.

U.S. Bureau of Standards :

Research Paper RP 728. CRITICAL SOLUTION TEMPERATURES OF SOME HYDROCARBONS IN SULPHUR DIOXIDE. By Robert T. Leslie. 9 pp. 8vo. 1934, Supt. of Documents, Washington, D.C. 5c.

The variation with composition of the C.S.T. in sulphur dioxide of seventeen paraffin and naphthene hydrocarbons has been determined. Experiments have also been made with ammonia and aniline.

ABSTRACTS.

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Class 200. Geology and Origin.

115. Preliminary Study of Source Beds in Late Mesozoic Rocks on West Side of Sacramento Valley, California. P. D. Trask and H. E. Hammar. *Bull. Amer. Assoc. Petr. Geol.*, 1934, **18**, 1346–1373.—The thick series of sediments comprising the Shasta series (Lr. Cret.) and the Chico formation (Up. Cret.) outcrop in a long, narrow belt on the west side of the Sacramento Valley. Small quantities of oil and gas in seeps and in wells have drawn attention to the area, and tests were carried out with the object of determining whether adequate source rocks occur in the 40,000-ft. section. The Shasta series is mainly shale, with a certain amount of thinly-bedded sandstone, whereas the Chico formation is predominantly a sandy shale series. 480 samples were taken throughout the sequence, and the organic content was determined. Eight other samples—three from the vicinity of oil seeps—were analysed in more detail to show the character of the organic content. The organic content is low, and is uniformly distributed in quantity and character throughout the sequence. The detailed analyses show a difference in character between the organic matter in samples taken at seepages and those taken elsewhere. The conclusion is therefore that the greater part of the Shasta or the Chico formations is possible source rock, although the difference between seepage material and that elsewhere is not encouraging.

S. E. C.

116. Summary of Recent Research Work upon Organic Content of Sediments. P. D. Trask and H. E. Hammar. *Oil & Gas J.*, 22.11.34, **33** (27), 43; 29.11.34, **33** (28), 40; 6.12.34, **33** (29), 36.—The aim of the research has been to try to discover features which would characterise an oil source rock, or rocks associated with petroleum.

Some 25,000 samples were collected, and one or more of the following tests were carried out on each: carbon content, nitrogen content, volatility, texture, and degree of oxidation. The methods of carrying out the two latter tests are briefly described, and a table containing the results of the analyses is given.

The areas represented by the samples are California, Rocky Mtns., Mid-Continent, and Texas. Some of the samples are from weathered outcrops, but the majority are rotary cores or cable tool-cuttings, and they have been correlated into 120 different formations or parts of formations.

The results of the work show that relatively little organic matter is found in sediments, the largest percentage in any one of the 120 formations considered being just above 5, although individual samples sometimes contain more. The lateral and vertical variations in organic content are traced through the various formations, and have been plotted on maps of the districts, and a certain linearity has been obtained.

The general conclusions formed are that the quantity of organic matter in a sediment would increase with the distance from the shore, although local deeps near the shore would be particularly favourable for its accumulation. Sediments deposited in areas of diastrophism vary locally in organic content, but there is a gradual and uniform change in those areas unaffected by diastrophism.

The fact that the average organic content of sediments is about 1·5% indicates that only a relatively small amount is necessary for the generation of oil in commercial quantities. It has been calculated that the loss of organic matter after deposition is not more than 50%, therefore an original average content of between 4% and 8% is sufficient for the generation of commercial oilpools.

In an area where the beds alternate from fine clays (containing the organic material) to sandy beds, the latter form favourable migration channels for the oil generated in the clays, and this is suggested as a possible reason for the greater yield of some sediments as compared with others which contain as much, or more, organic material, yet the oilpools associated with them are not so large.

In areas such as East Texas, where the organic content of the presumed source rock is now about 1·5% or lower, it is suggested that a considerable portion of the oil has migrated from the centre of the basin, where the organic content is higher, to the edge. This latter point is emphasised because, until the laws governing migration are fully elucidated, it is difficult to indicate rocks which will probably give rise to the generation of oil and those which are unlikely to do so.

J. A. G.

117. Relationship of Geology to Unit Operation of Oil and Gas Fields, involving Government Lands. C. D. Avery and J. C. Miller. *Bull. Amer. Assoc. Petr. Geol.*, 1934, **18**,

1454–1492.—The object of this paper is to acquaint geologists with the laws and procedure concerning unit operation on government lands, and with that object in view six examples are taken and analysed. These are: North and Middle domes, Kettleman Hills, California; Little Buffalo Basin, Big Sand Draw, Billy Creek, and Pitchfork fields, Wyoming; and McCullum field, Colorado. S. E. C.

118. Correlation of Pecan Gap Chalk in Texas. A. C. Ellisor and J. Teagle. *Bull. Amer. Assoc. Petr. Geol.*, 1934, **18**, 1506–1536.—The Pecan Gap chalk was mapped from the original type locality at White Cliffs, Arkansas, across N.-E. Texas to Pecan Gap (Delta County), and then south-west to Medina County, Texas. On the basis of its microfauna it can be divided into three zones: the "Flabellammina compressa" zone (basal), the "Diploschiza cretacea" zone, and the "Bolivina incressata" zone. The more important localities are described in the case of each zone. Two unconformities are indicated by the mapping, one being at the base of the chalk and cutting out the "Flabellammina compressa" zone in Hunt and Delta counties. The other unconformity occurs at the top of the chalk, and from Bowie County westwards through Red River county transgresses older and older beds of the chalk. The Pecan Gap chalk is useful as a marker horizon for subsurface purposes. In tracing it from Hunt County to Medina County, it is shown that it transgresses the Taylor, the Gober chalk, and the Brownstown, which lies between it and the Austin Chalk in the Hunt County. S. E. C.

119. Louisiana Coast. B. Mills. *Oil Weekly*, 10.12.34, **75** (13), 16–20.—The Bosco field of Acadia Parish appears to be associated with a deep-seated salt dome. The wells pass through more than 9000 ft. of Recent, Pleistocene, Pliocene, Miocene, and Oligocene beds, and 90% of the beds to a depth of 7600 ft. are sands and soft shales, the former predominating. The productive sands are believed to be exceptionally thick. Oil is obtained from sands in the Discorbis zone (Mioc. or Olig.) and the Heterostegina zone below. The Marginula zone has been reached by only a few wells in the inner area, but the Frio sand has not been identified, although an oil and a gas sand were encountered. The dome has been partly defined.

The Roanoke field is 38 miles to the west in Jefferson Davis Parish. In many respects it is similar to the Bosco field, and production has been obtained from the Marginula zone. G. D. H.

120. Geological and Drilling History of Knight's Dome, South Australia. A. E. Knight. *Oil Weekly*, 24.12.34, **76** (2), 35–36.—Knight's dome lies a few miles west of the town of Mt. Gambier. The surface rocks are basal Miocene and Oligocene of the Polyzoal limestone series. To the north they extend for several hundred miles, and for the most part lie directly on the older granite and pre-Cambrian floor. To the east they terminate in the Gipsland basin, where some oil has been found at their base. Their western extension is masked, and southwards they continue under the Pacific. In the extreme southerly coastal regions, however, they occupy the lower south-east of S. Australia, and the lower south-western portion of Victoria, and there is a pronounced thickening, bringing in Oligocene and possibly Eocene deltaic deposits.

Slabs of bituminous material are frequently washed up on the coast. The exact source is unknown, but is probably near at hand. A seepage of a peculiar oil is known on the Glenelg river. The attempts at drilling to the structure have not been carried out at all satisfactorily, but a test on one gave strong shows of heavy oil. G. D. H.

121. Structure of Turner Valley Gas and Oil Field, Alberta. T. A. Link and P. D. Moore. *Bull. Amer. Assoc. Petr. Geol.*, 1934, **18**, 1417–1453.—The Turner Valley field is structurally one of the most complicated in N. America. The faulted and tightly folded anticline of Palæozoic limestone from which production is obtained is underlain by a major thrust fault. On the west this structure is bounded by two similar overthrust sheets. The formations beneath the major thrust fault are also highly folded and faulted. It is suggested that the Turner Valley structure is not a true "nappe." The reverse limb of the anticline does not appear to have been stretched, but rather the limestone appears to be the crest of a previously developed fold sheared off along a thrust fault emerging from the west and carried eastwards. This thrust sheet slid along a plane dipping gently westwards, but it emerges at the surface at a high angle. The Belly River coal seam to the east probably provides a zone of easy movement, as in the case of other fault planes in the foothills.

Wells drilled into the Palæozoic limestone on the Highwood over-thrust sheet to the west of the Turner Valley over-thrust sheet yielded sulphur water under a hydrostatic head considerably higher than the highest point of the limestone in Turner Valley. In Turner Valley no considerable amount of water has been found. This and the fact that all wells in Turner Valley have already suffered considerable decline in pressure therefore point to the fact that the limestone there is disconnected with that to the west. Furthermore, on account of the underlying thrust plane, it is not connected with the Alberta syncline on the east. The upper Palæozoic limestone and the Fernie shales are the probable source rocks, and it is suggested that migration preceded major structural movements, the effect of later movement being compression of the limestone, with accompanying rise in gas pressure. Production is obtained from a porous dolomitised zone, in which fracturing appears to have played an important part.

The paper concludes with a discussion of the orogenic history of the Turner Valley structure. S. E. C.

122. Zones in Alberta Shale (Benton Group) in Foothills of S.-W. Alberta. J. B. Webb and L. G. Hertlein. *Bull. Amer. Assoc. Petr. Geol.*, 1934, **18**, 1387–1416.—The so-called "Benton formation" of S.-W. Alberta is here referred to as the "Alberta Shale," and is subdivided into the Blackstone, Cardium, and Wapiabi formations. Each of these can be divided into definite lithologic zones which are useful in mapping.

The Blackstone formation, a series of dark, well-bedded, marine shales, overlies the Blairmore formation, and passes upwards into the base of the Cardium formation. The thickness is 900–1000 ft., although it tends to thin out south of the Ghost River. This tendency is also shown by the Cardium formation, which is a series of hard sandstones and sandy shales of marine origin and totalling about 275 ft. On the Ghost River an E.–W. change in lithology can be seen, the sandstones of the Lower Cardium being replaced by shales with thin sandstone bands. In passing from the Cardium to the Wapiabi formation, there is a change in lithology from sandstone to shale. Some lithological changes occur in the upper zones of the Wapiabi south of Ghost River. Measurements of thickness are difficult on account of folding and thrusting; an average figure is 1400–1500 ft. These shales pass upwards into the fresh-water Belly River formation.

Four palæontological zones can be distinguished. It is possible to correlate the Alberta shale with similar zones in the Colorado formation of N. Montana and central Great Plains region, and with zones in the Colorado and basal Montana formations of the Rocky Mountains area. There is also evidence for correlating the Blackstone with the Turonian, and the Cardium and the Wapiabi with the Lower Senonian. S. E. C.

123. Important Operations in South Alberta. Anon. *Oil News*, 1934, **36**, 454.—A well drilled on the southern flank of the Twin River structure flowed at an initial rate of 500 brl. of oil and 8,000,000 cu. ft. of wet gas from the Madison Lime. Field work and shallow core drilling have established the presence of the Del Bonita structure 10 miles to the west. A test well is to be drilled to the Madison Lime. This well is 20 miles north-west of the Cutbank monocline in Montana. Production is expected from the Blackleaf, Sunburst, and Cutbank sands at 3500–4850 ft., and from the Madison Lime at 5100 ft. G. D. H.

124. Oil Resources of the Soviet Union. Selsky. *Petr. Times*, 1934, **32**, 687–688.—Kala and Lok-Batan fields do not exhaust the possibilities of the Apsheron peninsula, and prospecting has revealed structures at Zykhe, Mardyakan, Tiurkyan, and Kiurdakhan. Wells sunk at Zykhe have logged similar strata to Kara-Chukhur, and the presence of gas indicates a close approach to productive sands. Drilling is in progress or about to start on the other structures.

The whole coast of the Apsheron peninsula is to be examined closely, following the location of signs of oil at Shongar and Kyzil Teppe, and submarine prospecting is also to be undertaken.

Commercial oil flows have been obtained at Djengy, associated with the Khurdalan fold, at Cheill-Dagge, Ragamme, and Kianazze-Dagge, whilst five excellent structures are known in the Ganjin region.

Work at Grozny has revealed an over-thrust, the under-limb of which is highly

petroliferous. The great depth is the major difficulty in obtaining production from deeper sands at Maikop.

The 12-km. Malgobek fold, arising from the Voznesensk fold, has three new productive horizons.

Gas seeps are known in the eastern part of the trans-Terex tableland. Signs of oil and gas occur in the Taman and Kerch peninsulas, and oil has been proved in the deeper Mesozoic strata of the Kuban, where favourable structures exist.

Many salt domes with signs of oil have been located in the Ural-Emba region, but the semi-desert conditions obtaining hinder development.

The Ishimbævo fields yield oil from the Carboniferous limestone, and, far to the west of these, two wells at the Samara bend have shown oil at identical horizons, although 80 km. apart. The same strata have given oil at Chusovsky Gorodok, near Perm.

The structure of the western slope of the Urals from the mouth of the Pechora down to Orenburg and Uralsk is closely akin to the Appalachian region of America, although of less extent.

In Middle Asia, limestones are petroliferous in the Ferghana Valley, where prospecting has revealed sixty-three structures which have yet to be tested. The most important is a fold 12 km. long near Khaudag, on which a gusher has been drilled to a Palæozoic limestone. Oil has been found there in the Jurassic also.

On Cheleken Island, in the Eastern Caspian area, deeper horizons are being explored, and twenty-seven productive horizons are supposed amongst the complex folds of Mirzlani and Shiraki in S. Georgia.

The main territory of Siberia is still untouched, but oil has been found in the Novaya Zemlia, on the Taimir peninsula, at the mouth of the river Lena, on the east and west coasts of Kamchatka, at Lake Baikal, and in a number of folds in Sakhalin.

G. D. H.

Class 300. Development and Production.

125. Progress in Development—Kettleman North and Middle Dome Fields. H. V. Dodd and E. J. Kaplow. *Summary of Operations Calif. Oil-fields*, 1933, 1st Quarter, **18** (4), 5–20.—A report covering recent development operations, underground conditions, production, water conditions, and casing programmes. Reference is made to three comparatively new developments being employed in Kettleman North Dome, namely, the measurement of bottom hole pressures and their application to practical problems, the use of formation testers, and the Schlumberger "electrical coring" device.

W. W.

126. Louisiana Coast's Easy Drilling Conditions Factor in Deep Pay. B. Mills. *Oil Weekly*, 10.12.34, **75** (13), 16.—The development of the deep horizons of the Louisiana Gulf Coast has been influenced by improved drilling methods and more effective application of geophysics. This area is now one of the deepest-producing districts in the world.

Wells are now being drilled to 8000 and 9000 ft. at speeds and costs less than those required in many of the other deep fields.

More than 90% of the formations down to nearly 8000 ft. are sand and soft shales, with sands definitely predominating. Sedimentary deposits along strips of the Louisiana Gulf Coast have a thickness of from 15,000 to 20,000 ft., and promising deposits here and in California appear to have a thickness greater than can be penetrated with present drilling methods.

A number of records have been put up in the Bosco Field. One well was drilled to 7000 ft. in 7 days' drilling, and less than 3 weeks elapsed before this well was completed and tested. Vibrating screens, boilers, slush pumps, and swivel installations of the latest type were used at this well.

The Louisiana Gulf Coast may be considered one of the most important oil-producing districts of the U.S.A. The deep-seated salt domes along a given strip may be developed with a minimum of expense and effort. Few development hazards, apart from the great expense of proving indicated structure, should be experienced.

L. V. W. C.

127. Portable Generator for A.C. Rig. W. C. Lane. *Oil Weekly*, 17.12.34, **76** (1), 29.—The electric rig assembled by a contractor in the Oklahoma City Field is an interesting example of what can be done with stock equipment.

The drilling motor is a 150-h.p., 440-v., 3-phase, 60-cyc., 900-r.p.m. model, with a magnetic controller, and the slush pump is operated by a similar type motor, but of 200 h.p. These motors are standard drilling types.

The generating unit consists of a 500-h.p., 8-cyl., 1200-r.p.m. gas engine direct connected to a 375-KVA 480-v., 3-phase, 60-cyc. A.C. generator to which is coupled a suitable exciter. The three machines are mounted permanently on steel skids.

A spray tower is provided for the engine cooling water.

The voltage is maintained at the desired value by the use of a potential regulator of the vibrating type. L. V. W. C.

128. Drill Pipe Twist-offs. L. G. E. Bignell. *Oil & Gas J.*, 29.11.34, **33** (28), 12.—The Permian Basin of W. Texas and New Mexico consists of a series of salt beds of varying thickness interspersed with beds of shale.

The drilling mud of the rotary system dissolves some of the salt, creating cavities varying in depth and radius. Immediately below the salt, hard strata are found which slow up the drilling rate, and twist-offs of drill stems have occurred in many wells as a result of this condition.

The creation of these cavities would definitely tend to increase the prevalence of twist-offs, and methods of prevention have been devised.

In many wells hydraulic drill pipe is used on the lower end of the ordinary drill stem. The extra stiffness obtained by the use of such pipe prevents bouncing as the bit digs into the hard formation.

Twist-offs were prevented in some wells by the use of from 5 to 7% of Aquagel in water to form a drilling fluid for use in the salt formations. The theory is to form a wall of mud on the face of the salt, and so prevent entry of the water.

The cause of failure is dealt with by the author by an examination of Euler's long-column formula. L. V. W. C.

129. Strength of Thin Shells Subject to External Fluid Pressure. J. Gilson. *Engineering*, 1934, **138**, 432.—The derivation of formulæ for use in designing thin shells of cylindrical and spherical form subject to an external fluid pressure is explained in this article, which, in the author's words, is an attempt to develop a reasonably accurate treatment of the subject more in line with commercial requirements than the use of various standard rules governing the thickness of plates. W. W.

130. Progress in Combating Heaving Shale Problem in Gulf Coast Deep Tests. N. Williams. *Oil & Gas J.*, 13.12.34, **33** (30), 11.—Definite progress has been made in the Louise Field of Wharton County in combating heaving shale.

The method adopted for combating the shale was unique in that all native muds and cuttings were discarded, and only synthetic drilling muds were used.

The synthetic mud consisted of combinations of caustic sodium, a bentonitic clay, and quebracho, with admixtures of Baroid, Colox, and other preparations when needed. The percentage of bentonite was as much as 40, this high percentage being used to eliminate the possibility of there being any free water in the fluid. Viscosity was controlled by the use of chemicals.

The mud was carefully conditioned by a series of traps and pits, and, to prevent any water from getting into the mud as a result of rains, the entire mud system was roofed in. L. V. W. C.

131. Mechanical Down-time Analysis Advances Pumping Technique. III. & IV. I. F. Bingham. *Oil Weekly*, 10.12.34, **75** (13), 30; 17.12.34, **76** (1), 22.—The first paper, which is the third article of a series (cf. Abstr. 29), deals with belting.

Certain rules for the installation and care of cut length belts are given, the observance of which will definitely result in the belts giving more satisfactory service.

A summary of the belt down-time is also given.

Part IV is devoted to pumps and tubing, and tables are given for the down-time of all makes of pumps and tubing. L. V. W. C.

132. Care and Operation of Small Oil Wells—Gas Properties. J. H. Newlon. *A. P. I. Prod. Bull.* No. 213, May, 1934, 56.—The article deals with the natural-gas fields of the eastern United States which lie almost entirely in the great Appalachian basin. Some of the difficulties to be overcome in the maintenance of small gas wells are: Accumulation of salt water and the subsequent salting of the face of the sand and

tubing; accumulation of paraffin; cavings from upper sands, shales, and clays; leakage from poorly-set casing strings and packers; faulty strings of tubing. Some of the methods in use at the present time to overcome these difficulties are: Holding proper back pressure; removal of water by swabbing, bailing out, pumping, or siphoning; shooting; cleaning out, re-casing and re-tubing; minimum size tubing and casing slotted perforations. A statement on each method is given. W. W.

133. Correlating Comparison of Chart Interpretations. F. B. Taylor, *Jr. Oil Weekly*, 10.12.34, **75** (13), 35.—Accurate atmospheric pressure standards for the particular localities are necessary where direct-reading orifice meter charts have been installed. It is also necessary to have on hand a means of correlating the readings of the standard and the direct-reading charts where both are in use.

Charts are given which enable the standard chart recording to be transposed to direct recording, or vice versa. L. V. W. C.

134. Rate of Solution of Methane in Quiescent Liquid Hydrocarbons. II. E. S. Hill and W. N. Lacey. *Ind. Eng. Chem.*, 1934, **26**, 1324.—Repressuring of oil-fields has been used since 1912, and as a result there has been a need for information on the rate at which gas dissolves in the oil formation.

In this paper experiments are described in which the diffusion coefficient of methane was determined in twenty-six liquids. These liquids included pure hydrocarbons (pentane–octane, and benzene), kerosines, spray oils, petrolatum, and various crudes. The apparatus used has been described in an earlier article (*Ind. Eng. Chem.*, 1933, **25**, 1014).

The experimental results are given in a set of graphs. All experiments were carried out at a partial pressure of 300 lb./sq. in., and at temperatures of 30° C., 45° C., and 60° C. The solubility of methane is plotted against the specific gravity and viscosity of the oil. The latter plot gives a somewhat better correlation. Further graphs show the relation between increase in volume of liquid and volume of methane dissolved; and between increase in liquid volume per unit volume of gas dissolved and the solubility.

Various correlation curves can be drawn for the diffusion constants of the various oils. An investigation of the literature failed to produce any laws on which the correlation can be based. It was found that good correlation could be obtained by plotting diffusion coefficient against an empirical function of temperature and viscosity of the liquid. P. D.

135. Rate of Solution of Propane in Quiescent Liquid Hydrocarbons. E. S. Hill and W. N. Lacey. *Ind. Eng. Chem.*, 1934, **26**, 1327.—The rate of solution of propane was determined in two refined oils (kerosine and spray oil). The apparatus used (with slight modifications) was the one described in *Ind. Eng. Chem.*, 1933, **25**. The temperatures of determination were 30° C., 45° C., and 60° C., and measurements were made at pressures up to 67% of the vapour pressure of liquid propane at these temperatures. The increase in volume of the liquid, and the final amount of gas dissolved were also determined.

The expansion of the liquid volume due to solution of propane is plotted against the partial pressure; and the solubility against percentage of the vapour pressure of liquid propane. The relation between specific gravity and viscosity of spray oil with propane in solution, and the partial pressure of the propane is shown graphically. Further graphs show the effect of increasing the volume of liquid on solution rate, and variation of diffusion constant with concentration of the corresponding solution.

The results are also presented in the form of a table. P. D.

136. Relation of Sub-surface Factors to Well-head Control in its Influence on Rate of Flow. K. W. G. Patterson. *J.I.P.T.*, 1934, **20**, 1100–1112.—A paper with discussion on the qualitative effects of the various factors that determine the rate of flow of oil from a well at the surface. G. R. N.

137. Repressuring Experiment is Interesting. C. I. Layton. *Oil Weekly*, 10.12.34, **75** (13), 21.—An effort is being made in N.-E. Kansas to re-pressure flush sands in shallow, narrow fields that yield small pumping wells.

The method in use at present to bring the oil from the producing wells is a flushing process.

This process requires the selection and preparation of one well in the field. The pressure was gradually built up from 80 to 275 lb., and in a space of 3 weeks the wells surrounding the key well had increased production by 125%. The pressure is built up on the producing well for a period of time, and then suddenly released. The air rushing back out of the sand brings the oil with it, and good results have been achieved.

One well to which this operation was applied has produced 729 brl., whereas at its previous rate only 237½ brl. would have been obtained. L. V. W. C.

138. Increased Recovery by Applying Air and Gas Pressure to Oil Sands. C. C. Hogg. *A.P.I. Prod. Bull.* No. 213, May, 1934, 71.—Describes some work that has had a measure of success, and indicates the solution of some of the small oil producer's problems on the Pennsylvanian field. W. W.

139. System of Manifolding Permits Control of Gas Lift Operations. J. C. Albright. *Oil Weekly*, 10.12.35, **75** (13), 34.—A gas-lift method which differs from conventional practices in many respects is being applied in the Santa Fe Springs field. The wells in the system are tied together by means of an unusual manifold system.

Several classes of wells were found to exist in this field, some requiring a small volume of gas with lower input pressure to maintain the desired rate, others requiring a high volume of gas with high input pressure.

The Union Oil Company engineers worked out a system to take advantage of the higher gas pressure coming from some wells, and to use the gas coming from others that had performed its proper function, but could be received from the separators with a pressure sufficiently high that it could be employed as input gas in other wells without the necessity of passing it through the compressors.

A description of this system, together with a set-up diagram, is given.

L. V. W. C.

140. Stage Lifting Applied to Gas-lift Operations. F. Swindell. *Oil Weekly*, 17.12.34, **76** (1), 19.—A new type of stage-lift device is being tried out in the Oklahoma City Field, where the producing depths are around 6500 ft.

In one recent installation stage lift was introduced into a 6480-ft. well where the pressure was 300 lb./sq. in. and the production was 300 brl. daily, using about 3500 cu. ft. of input gas per brl. of oil. After the installation of the stage lift the production increased to 600 brl. of oil, and the quantity of input gas decreased to 1500 cu. ft. per brl. of oil. There was also an increase in the A.P.I. gravity.

Diagrams are given showing clearly the manner in which this stage lift is operated.

L. V. W. C.

141. Patents on Drilling Equipment. T. L. Lynch, H. L. Riding, and H. A. Redfield, U.S.P. 1,979,481, 6.11.34. Device for Indicating Inclination in Wells.

D. J. Hamon, U.S.P. 1,979,740, 6.11.34. Well Strainer.

H. L. Turney, U.S.P. 1,979,780, 6.11.34. Draw Works.

M. M. Kinley, U.S.P. 1,979,802, 6.11.34. Plugging Device for use in Torpedoing Wells.

C. M. Livingston, U.S.P. 1,979,803, 6.11.34. Straight Lift Pumping Unit.

J. S. Morris, U.S.P. 1,980,219, 13.11.34. Pressure Release for Sand-testing Tools.

W. A. Hunsucker, U.S.P. 1,980,529, 13.11.34. Orienting Device for Core Drills.

M. Manning, U.S.P. 1,980,942, 13.11.34. Method and Apparatus for Cementing Wells.

P. Deming, U.S.P. 1,980,985 and 1,980,986, 20.11.34. Well Pump.

C. E. Burt, U.S.P. 1,981,262, 20.11.34. Plunger and Screen for Hydraulic Underreamers.

L. M. C. Seamark, U.S.P. 1,981,431, 20.11.34. Casing-head Equipment for Wells.

B. E. Price, U.S.P. 1,981,525, 20.11.34. Method of and Apparatus for Drilling Wells.

F. Reiler, U.S.P. 1,981,665, 20.11.34. Surveying Instrument for Determining Inclination in Bore-holes.

E. P. Weatherly, U.S.P. 1,981,817, 20.11.34. Bottom-hole Sampling Device.

J. C. Harris, U.S.P. 1,981,863, 27.11.34. Tool Joint.

A. G. Higgin, U.S.P. 1,982,252, 27.11.34. Oil Saver. L. V. W. C.

Class 400. Transportation, Storage, and Distribution.

142. Preparing Oil for Pipe-line Transportation. L. P. Stockman. *Oil & Gas J.*, 13.12.34, **33** (30), 13.—There is an urgent need for standardization of gauging and sampling methods, since there are a number of methods at present in use, and all of them have certain inherent weaknesses. The actual condition and quality of the oil passing through the line are difficult to determine, and the systems which are recognised as being very accurate are generally too complicated for general use.

At present no crude oil showing a cut of more than 3% is being pumped, but this maximum is too high, and a reduction will have to be made. Dehydration is carried out to enable a larger quantity of crude to be pumped through the line. Salt water is reduced to a minimum, to prevent as much as possible the corrosion of the line.

Numerous methods are available to determine the amount of water and insoluble impurities in crude oil, but again these have their limitations and disadvantages.

The gauging of gasoline and natural gasoline is done under pressure, in order that a sample may be secured almost identical with the gasoline in the tank. This is obtained by means of a steel bomb.

Vapour displacement and air displacement are believed to be the most common forms used in securing samples, but, since volume is vitally affected by temperature, it is necessary to take extra precautions to see that the conditions prevailing within the tank under pressure are duplicated as near as possible. L. V. W. C.

143. Estimation of the Weight of the Contents of a Tank. Anon. *Erdöl u. Teer*, 1934, **10**, 431–432.—A device is described by which the weight of oil in a tank may be obtained without introducing the questions of specific gravity of the oil and the total depth of liquid. Each tank is provided near the bottom with a fixed glass U-tube containing mercury. This is connected to a portable manometer and air chamber. A pressure is developed in the latter by means of a hand pump until the levels of the mercury in the U-tube are again uniform. From the manometer reading, knowing the area of the bottom of the tank, the weight of oil is obtained by suitable tables. Corrections must be applied to the manometer reading for temperature changes. C. C.

144. Pipe Protection by applied bitumen. Anon. *Ind. Chem.*, 1934, **10**, 417–422.—The process described is that used by Messrs. Stewarts and Lloyds in their British Tube Works near Glasgow. The bitumen is heated by means of the Kestner Patent Oil circulation heating system. The hot oil circulates through coils immersed in the bitumen melting-tank, the molten bitumen passing on to mixers for incorporation of fillers as desired. The pipe to be coated is first heated by means of an oil burner placed at its mouth, and then centred in a lathe. A certain quantity of bitumen is poured into the pipe, the amount depending on the thickness of coat required, and, by quick rotation, the centrifugal force causes the bitumen to form an even coating inside the tube. The latter is cooled by a series of impinging water-jets. R. E. D.

145. Bituminous Coatings for Underground Pipes. G. O. Thomas. *J. Inst. Eng. Australia*, 1934, **6**, 337–346.—Deals with the testing of bituminous materials the suitability of which as pipe coatings is to be ascertained. Standard methods of testing are discussed and methods evolved to obtain data not available from standard methods are described; some results are given. The most important of these is the determination of rate of absorption of water by the material. The application of the results of this research to the practice of pipe-coating is outlined. Full details of methods of testing and a discussion of a rational method of determining the economical thickness of coating are appended.

The results given were obtained during a period of 4 years' work on the subject in the laboratory, factory, and field. The pipes dealt with in this article are steel water-mains, factory-coated.

Remarking on the coatings, it is stated that coal tars and their pitches, together with prepared enamels (coal tar base), have been proved outstandingly the best water resistants, with vertical retort tar (treated or untreated) considerably inferior to horizontal retort and coke-oven tar It appears as if water will not creep under the coating from weak spots, as it does markedly in the case of oil bitumen, and to a smaller extent with mixtures of natural asphalt and tar.

Results of the tests show that horizontal retort coal-tar pitch excels all other common bituminous material in its resistance to water and permanent adhesion to steel. W. W.

Class 500. Properties and their Determination.

146. Apparatus for Measuring the Vapour Pressure of Benzine. R. Salmoni. *Giorn. Chim. Ind. Appl.*, 1934, **16**, 483–485.—The apparatus consists essentially of two similar graduated tubes surmounted by similar glass bulbs. To the lower end of each tube mercury levelling-tubes are attached by rubber tubing. Above each bulb is a 3-way stop-cock, each of which is connected to a single stop-cock, through which connection of one tube is made to a capillary tube dipping below the surface of the liquid under examination contained in a closed tube, whist the same stop-cock connects the second tube to the space above the liquid. The first tube is filled with dry air by suitable manipulation of the levelling tube and stop-cock. The volume of air is measured, and it is then saturated with vapour by bubbling through the liquid via the capillary tube, and transferred in the process to the second tube, keeping the pressure as nearly as possible atmospheric. The total volume is then measured in the second tube, and the partial pressure of the vapour is given by the formula $p = P(1 - V_1/V_2)$, where P = atm. pressure, V_1 = initial volume of air, and V_2 = volume of air saturated with vapour. Possible errors due *e.g.*, to fluctuating pressures in the second tube, to incomplete saturation, and to dead spaces in the capillary and saturator, are discussed, together with methods for reducing such errors to a minimum. C. C.

147. Fractionation of the Low Boiling-point Mixtures of Hydrocarbons of Liquefied Natural Gas. K. Kling and B. Wieclawek. *Przem. Chem.*, 1934 (10–12), 425–433.—An apparatus serving for the complete fractionation of mixtures has been constructed, and its action tested in the case of the mixture of homologous hydrocarbons present in so-called "Gazol."

A critical study has been made of the fundamental parts of the distillation apparatus, and a number of modifications have been introduced in the construction of the condenser, and the head of the distilling vessel, and in the technique of heating and of receiving the various fractions.

Ethane, propane, *n*-butane, and *iso*butane have been isolated, and the boiling-point, density, and vapour pressure of the three last-named hydrocarbons have been determined with a technical degree of accuracy, and compared with the values obtained for products of American origin. E. F.

148. Determination of the Saponification Value of Lubricating Oils. P. Honig and P. J. Klokkers. *Chem. Weekblad*, 1934, **41**, 643.—A study has been made of the behaviour of a number of lubricating oils in relation to their volatility with steam, especially of compounded oils. It was necessary to devise an accurate method for the determination of the content of free or fixed fatty acid. In the meantime, saponification values were used as a criterion for the changes of oil during use. The A.S.T.M. 1933 method and that of Richtlinien gave different values, but the latter could be improved by neutralising the excessive amount of 0·25*N*-alcoholic KOH with HCl solution of the same normality. Both methods were applied to a blend of Mobiloil B.B. and castor oil, the Richtlinien method giving results agreeing to within 0·28 of a unit, whilst in the A.S.T.M. the divergencies were considerably greater. The modified Richtlinien method gave results nearest to the exact values. P. C. K.

149. Formaldehyde Formation by Preflame Reactions in an Engine. L. Withrow and G. M. Rassweiler. *Ind. Eng. Chem.*, 1934, **26**, 1256.—A study has been made of the spectral absorption in that portion of the combustion space of an engine where knocking may occur. Formaldehyde was always found in the non-inflamed gases under knocking conditions, but its concentration was increased when either *iso*propyl nitrite or diethyl peroxide was added to the fuel to induce knock. Two fuels of the same anti-knock value under the same engine conditions may not form the same maximum concentrations of formaldehyde in the non-inflamed gases. Formaldehyde may be detected in the latter under non-knocking conditions, but the absorption bands disappear if the octane number of the fuel is increased other than by adding tetraethyl lead, or if the other engine variables are adjusted to reduce knocking. The addition of

tetraethyl lead did not appreciably affect formaldehyde concentration even when the concentration was sufficient to entirely suppress knocking. The addition of aniline to the same extent, however, appreciably decreased the formaldehyde concentration.
W. H. T.

150. Addition of Gaseous Hydrogen Chloride and Bromide to Propane by the Use of Catalysts. L. G. Brouwer and J. P. Wibaut. *Rec. Trav. Chim.*, 1934, **53**, 1001.—It has been shown that in the addition of HCl to olefines, the catalyst appears to determine which of the isomerides will be formed, whilst with HBr, the 2-bromo addition product is formed independently of catalyst and temperature. The addition of HBr and HCl to propene at 20–140° C. has been studied in the presence of silica-gel or glass wool impregnated with metallic chlorides as catalysts. ($FeCl_3$, $BiCl_3$, $ZnCl_2$ at room temp., and $NiCl_2$, $AlCl_3$, $CaCl_2$ at 80° C.) Under these conditions, 1-chloropropane could not be detected, but at 17–300° C. a yield of 2-bromo addition product was obtained, together with 1–2% of 1-bromopropane. The use of metallic bromides as catalysts offered no advantage in this reaction. The addition of HCl to propene was slow at room temperature when silica gel was used, but when HBr was used, the reaction proceeded smoothly. The results of Kharash on the "peroxide effect" observed by the addition of liquid HBr to liquid propene in the presence of benzoyl peroxide were verified, but an experiment carried out under the same conditions with liquid HCl and propene yielded 2-chloropropane only, hence there was no indication that the "peroxide effect" existed in this case. Free oxygen did not alter the course of the reaction between HBr and propene at room temperature and at 100° C. A theoretical survey and details of experiments are given of the equilibrium $CH_3CH_2CH_2Br \rightleftarrows CH_3CHBrCH_3$, and equilibrium concentrations at 250° C. and 275° C. were determined.
P. C. K.

151. Thermal Decomposition of Organic Compounds. XII. Decomposition of Methane. F. O. Rice and M. D. Dooley. *J.A.C.S.*, 1934, **56**, 2747–2749.—When methane is decomposed thermally in a flowing system, methyl groups escape from the furnace, and can be identified as dimethyl ditelluride. Methylene radicals are not apparently formed. Hence the primary decomposition is indicated to be $CH_4 \rightarrow CH_3 + H$ which is probably followed by $H + CH_4 \rightarrow H_2 + CH_3$.
W. E. J. B.

152. Chemistry of Acetylenes. I. Preparation of 1-Heptine by Dehalogenation Methods. G. B. Bachman and A. J. Hill. *J.A.C.S.*, 1934, **56**, 2730–2732.—The preparation and dehalogenation of various chloro- and bromo-derivatives of heptane and heptene have been undertaken with a view to determining the relative amounts of 1-heptine formed. Dehalogenation of 1 bromo-heptene-1 with four mols of KOH suspended in mineral oil gave 85–90% yields of 1-heptine. The action of heat, both in presence and absence of soda-lime, on this hydrocarbon has been studied. It polymerises rapidly at 300 °C., and the polymer cracks at 400°. Vapour phase dehalogenation was not satisfactory for the preparation of such acetylenes as 1-heptine.
W. E. J. B.

153. Isomerisation of Normal Butenes. V. N. Ipatieff, H. Pines, and R. E. Schaad. *J.A.C.S.*, 1934, **56**, 2696–2698.—The authors have studied the quantitative rearrangement of the normal butenes in the presence of certain catalysts, *e.g.*, orthophosphoric aid, perchloric acid, etc.

Isomerisation of 1- into 2-butene was slight in the presence of phosphoric acid at room temperature, but increased with rising temperature. At 249° C. isomerisation was complete under 7·8 atm. pressure, in the presence of diatomaceous earth, impregnated with orthophosphoric acid. Results with other catalysts and conditions are reported.
W. E. J. B.

154. Infra-red Absorption Spectra of Anthracene Hydrocarbons. P. Lambert and J. Lecomte. *Ann. des Comb. Liq.*, 1934, **9**, 979–993.—The authors have examined the infra-red spectra of anthracene and the diethyl, di-*n*-butyl, di*iso*butyl, and di*iso*amyl derivatives, as well as the *tetra*-, *octa*-, *deca*-, and the completely hydrogenated, anthracene. The wave-length used was from 6 to 20μ, and a description of the characteristic maxima for the above substances is given, together with graphical representations of the respective transmission curves. Reference is made to prior work on the absorption spectra of some petroleum oils, which the present work indicates to have contained certain anthracene hydrocarbons in one of the fractions examined.
W. E. J. B.

155. High-pressure Hydrogenation of Aromatic Compounds. I. High-pressure Hydrogenation of Benzene with Nickel Oxide. Y. Tanaka, R. Kobayashi, I. Endo, and T. Fujita. *J.S.C.I., Japan*, 1934, **37** (9), 538B–539B.—Previous work has shown that ordinary nickel catalysts impart very little activity to the hydrogenation of benzene unless very large quantities of the catalysts are used. The authors have shown that nickel and Japanese acid clay enable the hydrogenation of benzene at 180° C., and under 80 atm. pressure to proceed without any isomerism and side-reactions. An electrically heated autoclave constructed of nickel-chrome steel was used, and the conversion of benzene into *cyclo*hexane was completed in 60 mins. Hydrogenation could also be effected at 150° C. using a catalyst consisting of nickel and copper oxides.
W. S. E. C.

156. High-pressure Hydrogenation of Aromatic Compounds. Y. Tanaka and R. Kobayashi. *J.S.C.I., Japan*, 1934, **37**, 559B. Nickel oxide is readily reduced by high-pressure hydrogen at 180° C. in a medium of benzene, but not in a medium of saturated or unsaturated long-chain carbon compounds. The catalytic activity of very small amounts of nickel so reduced is sufficient to hydrogenate benzene or fatty oils at 150° C. The mechanism of the reaction consists of two phases: reduction of nickel oxide and hydrogenation of the benzene. If the two phases occur dependently, they tend to accelerate each other, and hence the reaction proceeds rapidly. The rapid and irregular crystal growth of the finely-divided nickel is thought to be responsible for its high degree of activity.
W. H. T.

157. High-pressure Hydrogenation of Aromatics. (Parts 4 & 5.) Y. Tanaka and R. Kobayashi. *J.S.C.I., Japan*, 1934, **37**, 669B. It is shown that the inhibiting action of saturated chain compounds on the high-pressure hydrogenation of benzene may be explained by the active centres of the catalytic surfaces being rendered inactive by the preferential adsorption of minute amounts of an inhibitant (*e.g.* saturated chain compounds). Benzene hydrogenation would therefore cease after such an inhibition, whilst ethylenic hydrogenation would proceed because the unsaturated chain compounds would be preferentially adsorbed in the presence of saturated chain compounds. In the case of ethylenic hydrogenation by a nickel catalyst, the inhibitory actions of water vapour and carbon dioxide are negligible, since these gases are chemically inert to the catalyst. Carbon dioxide is a transitory inhibitant in the high-pressure hydrogenation of benzene, whilst with a catalyst consisting of Japanese acid clay and mixed nickel and copper oxides, water vapour is a less active poison than carbon dioxide, since the clay absorbs water preferentially.
W. H. T.

158. Catalytic Hydrogenation of Phenolic Oil in Low-temperature Tar. II. S. Ando. *J.S.C.I., Japan*, 1934, **37**, 570B.—Experiments on the hydrogenation of the phenols from low-temperature tar have been carried out using an electrically heated autoclave and nickel oxide as a catalyst. It was found that the higher the initial pressure of hydrogen, the larger was the yield of benzine and the consumption of hydrogen. High reaction temperatures gave increased yields of gaseous hydrocarbons and benzine and increased consumption of hydrogen, whilst increases in the amount of catalyst used gave larger yields of light products and greater hydrogen consumption. The unconverted phenolic oil was found to have been purified as a result of the reaction. Higher alcohols of the *cyclo*hexanol series obtained by the catalytic hydrogenation may be acetylated for the production of esters of the *cyclo*hexylacetate series.
W. H. T.

159. Negative Catalysts of Hydrogenation of Oils. Inhibiting Influence of Dyestuffs at a Lower Temperature. S. Ueno. *J.S.C.I., Japan*, 1934, **37** (9), 497B–505B.—The hydrogenation was carried out by bubbling hydrogen through soya-bean oil to which 1% of the dyestuff under test was added and 2% of nickel was used as catalyst. The results show that direct colours have a weak inhibiting action, and a lower temperature hydrogenation tends to diminish this influence. Acid colours have a slight influence generally, due to ineffective radicals like $-(So_3Na)$ and $-OH$. Basic colours inhibit well. Sulphur colours act as poisons, and ice colours containing $-No_2$ have a retarding influence.

Generally $-OH$, $-So_3Na$ and $-CO_2Na$ radicals have a slight retarding influence, whilst $-NH_2$ and $-No_2$ groups are anticatalytic. On the other hand, $-NH_2$ and $-OH$, or $-No_2$ and $-NH_2$ when coexistent in the dyestuff, decrease the inhibiting

effect. The inhibiting action of a poison was very marked in the case of energetic hydrogenation, whilst in gentle hydrogenation the influence was slight.

W. S. E. C.

160. Production of Benzene Hydrocarbons from Methane by Thermal Decomposition. R. Oda. *J.S.C.I., Japan*, 1934, **37** (10), 630B–635B (in German).—Experiments are described in which gases containing methane are decomposed and liquid products obtained are adsorbed in silicic acid gel or activated carbon. When diluted methane gas and a larger reaction tube were used at higher temperatures for longer periods, 12 grs. of tar and 12 ml. of oil were obtained from 1 cb.m. of gas. When the initial gas was diluted with hydrogen, the yields of tar and oil were still very low; oxygen as a diluent gave no oil or tar, and the combustion was only partial. W. S. E. C.

161. Catalytic Decomposition of Thiophene. N. A. Orlov and A. S. Broun. *Khim Tverdogo Topliva*, 1932, **3**, 817–824.—The experiments were carried out with a solution of thiophene in gasoline, sp. gr. 0·7295 and boiling range 80–100° C., being freed from sulphur. The thiophene had a sp. gr. of 1·064 and boiling range 83–84° C. The following catalysts were used: (1) mixt. of NiO, CoO, Al_2O_3, and MgO (42 : 3 : 5 : 1), (2) CoO, (3) MoO_3. These catalysts were first reduced so as to give them a pyrophoric character. They were then placed in a glass tube, which was heated at various temperatures and through which 25 grs. of thiophene solution together with H_2 were passed. It was found that the NiO catalyst was best. The highest efficiency, *i.e.* removal of sulphur with NiO and CoO catalysts, was noticed at 400° C. and a hydrogen velocity of 25 ml./min. The spent NiO catalyst could not be recovered by treatment with air and hydrogen at 400° C. A poisoned catalyst does not remove sulphur, and the increase of the sulphur content from 1·60% to 2·65% has no detrimental influence on the activity of the catalyst. More sulphur is removed by prolonging the contact of the catalyst with the substance. Up to 70% of the sulphur could be removed in the above manner. 50–60% of the remaining sulphur is composed of elementary sulphur, mercaptans, disulphides, and sulphides, which can easily be removed.

For. Petr. Techn.

162. Catalytic Phenomena in Cracked Gasoline. A. Sachanen. *Chim. et Ind.*, 1934, **32**, 770.—The author differentiates between gasoline-soluble and gasoline-insoluble gums. The former is formed by oxidation–polymerisation reactions of unstable constituents of the gasoline to form colloidal compounds, whilst the latter is formed by the coagulation of this colloid. The differentiation between the two types of gum is supported by the fact that no differences in chemical composition have been detected, the average ultimate analysis being: C, 70%, H, 7%, O, 21%, and S, 2%. Data are presented showing the increase of soluble gum during a storage period of 300 days, of which an induction period of 60 days was observed. The addition of an inhibitor (0·001 to 0·1%) delayed gum formation for 6 months. The inhibiting action of various organic compounds was assessed, the most effective being mono- and di-benzyl *para*-aminophenol, catechol, α-naphthol, and diphenylhydrazine. Their effectiveness was found to be proportional to the concentration. P. C. K.

163. Absorption and Adsorption of Hydrogen by Nickel. J. Smittenberg. *Rec. Trav. Chim.*, 1934, **53**, 1065.—An investigation of absorption and adsorption of hydrogen by nickel wire is described, together with an outline of the apparatus used. The Knudsen effect influencing low-pressure measurements was determined, and the behaviour of the walls of the sorption vessel towards hydrogen was examined at low and high temperatures. There was no measurable adsorption of hydrogen on the walls of silica vessels at 90 lb. per sq. in. or at normal pressure. 650° C. appeared to be the most suitable temperature for accurate sorption measurements, the materials used being nickel wire (0·5–1% Mn) and hydrogen purified by a heated Pd tube and dried over P_2O_5. The absorption measurements included: pre-treatment of the nickel by heating it in stages to 900° C., degassing by evacuation, and flashing out with hydrogen; the determination of the isotherm at 300–600° C.—here the parabolic curve obtained appeared to be proportional to the square root of the pressure, the isobar showing that all measurements fall on a straight line with the exception of the results below 150° C. The quantitative agreement of results with those of Sievert would appear to suggest that the observed phenomenon was absorption or homogeneous solution of hydrogen in the nickel. The proportionality of the solubility with the square root of the

pressure may be explained by complete dissociation of the absorbed hydrogen molecules into atoms.

Adsorption measurements included: preliminary measurements before heat treatment of the nickel, which showed that the wire effected a slow sorption process at room temperature, the amount of hydrogen taken up being considerably diminished by a degassing heat treatment of the wire; measurements with hydrogen, helium, and argon; parallel experiments at low temperature with inert gases, which were carried out in order to obtain an idea of the adsorption capacity of the nickel surface. The author concludes that the adsorption of hydrogen by crystalline nickel is very small in comparison with the available surface. P. C. K.

164. Polymerisation of Olefins from Cracked Gases. V. N. Ipatieff and M. S. Nemtzov. *For. Petr. Techn.*, 1934, **2**, 247–248.—The polymerisation of ethylenic gas was investigated under conditions of liquid phase and hydrogenation cracking. The presence of hydrogen interfered with the thorough condensation of the olefins, the major portion of the final product boiling below 200° C. Mixtures of hydrogen and ethylene gave no liquid products; ethane was the chief product, although carbon was formed on the walls of the bomb. This carbon acted as a catalyst in succeeding experiments, and liquid condensates were obtained. While condensation was negligible below 350° C., hydrogenation was observed. Above 440° C. and at 300 atm. hydrogen pressure the maximum yield of condensate was obtained, and it yielded 75% of a gasoline fraction rich in aromatics. The theory of the reaction is discussed, and the effect of the catalysts, carbon, aluminium oxide, and fuller's earth was examined. G. R. N.

165. Nitrogen Compounds in Petroleum Distillates. R. W. Lackey and J. R. Bailey. *J.A.C.S.*, 1934, **56**, 2741–2743.—The naphthenic base $C_{16}H_{25}N$ from the kerosine distillate of California petroleum has been examined further (cf. Abs. No. 1128, 1933) and it has been found that formaldehyde condenses with this base around 200° and the resultant product yields, in nitric acid oxidation, a dicarboxylic acid which can be subsequently converted into a monocarboxylic acid and an oxygen-free base $C_{14}H_{21}N$. The latter is, apparently, completely saturated. The authors conclude that the formula of the original C_{16} base is restricted to trinuclear doubly-bridged ring systems. A provisional formula is advanced. W. E. J. B.

166. Research Motor for Heavy Fuels. H. Slowak. *Öl und Kohle*, 1934, **2**, 524–527.—This is a paper dealt with at the session on "Applications" of the German Institution for the Investigation of Mineral Oils held on April 27th, 1934. Tests for Diesel fuels using the C.F.R. motor are described. W. S. E. C.

167. Continuous Laboratory Topping Apparatus. H. T. Rall and H. M. Smith. *Ind. Eng. Chem., Anal.*, 1934, **6**, 373.—The apparatus consists of two parts, the heating circuit and the topping system. The heat needed by the process is supplied by hot vapours of a liquid boiling in a flask. These vapours ascend and pass to the top of the outside chamber of the isothermal heating unit. They pass through the chamber and out at the bottom, returning to the boiler. In practice the vapour stream should have sufficient velocity to maintain the temperature of the returning condensed vapour constant. The topping system consists of a flask containing the crude oil, which is drawn by means of vacuum into the top of the isothermal heating chamber, which consists of an 8-bulb condenser, the top 4 of which are packed with jack chain. While the crude oil is flowing downward, a stream of inert gas is admitted at the bottom of the heating chamber. This carries the light vapours into a packed fractionating tower, and ultimately to a condensate receiver, adequately cooled. The stripped oil passes through the still, and eventually runs out of a dripper into the topped-oil receiving flask. R. E. D.

168. Preventing Bumping in Vacuum Distillations. A. V. Morton. *Ind. Eng. Chem., Anal.*, 1934, **6**, 384.—Pyrex glass is powdered in a mortar, and sufficient is put into the distillation flask to cover the bottom evenly. The whole is heated until the powdered glass adheres, and after annealing the flask is ready for use. The thicker the coating of powdered glass, the more efficient is the distillation with regard to anti-bumping. R. E. D.

169. Stillhead for Rapid Concentration in Vacuo. H. B. Vickery and G. W. Pucher. *Ind. Eng. Chem., Anal.*, 1934, **6**, 372.—This consists of a larger-diameter vapour tube

connected to a cooling coil, which practically condenses the large volume of vapour delivered, before it passes to the condenser proper. A diagram is given. R. E. D.

170. Constant-temperature High-pressure Laboratory Autoclave. F. J. Dykstra and G. Calingaert. *Ind. Eng. Chem., Anal.*, 1934, **6**, 383.—This consists of a modification of the small high-pressure autoclave described by Peters and Stanger. The control of temperature of the autoclave is made independent of the heat evolved during the reaction by surrounding the reaction tube with a jacket filled with a suitably chosen liquid, which is kept at its boiling-point. The autoclave is rocked 20 times per minute over a 30° arc. R. E. D.

171. Melting-point Apparatus with Rapid Mechanical Stirring. K. S. Markley. *Ind. Eng. Chem., Anal.*, 15.11.34, **6** (6), 475.—The writer observes that the melting-point of pure hydrocarbons varies with the type of apparatus used for its determination. Observation indicated that melting-points were influenced by the rate and mode of heat transfer within the apparatus; it was found that unstirred baths gave the highest and high-speed mechanically stirred oil baths the lowest, values. The apparatus recommended consists of a high-speed circulating system (incorporated in a Thiele tube) effected by a turbine stirrer in one arm, and the thermometer and capillary tube holding the sample placed in the other arm of the tube. A diagram is given. R. E. D.

172. Agitator for Lamp Method Sulphur Titrations. L. Dolan. *Ind. Eng. Chem., Anal.*, 1934, **6**, 388.—By manipulation of a conveniently placed 3-way stopcock, connected to an air supply and a vacuum line, a continuous and uniform agitation may be secured during titration. A diagram is given. R. E. D.

173. Determination of Lead Soaps in Oils and Greases. H. Levin. *Ind. Eng. Chem., Anal.*, 1934, **6**, 333.—The method depends on the fact that the sample to be analysed is soluble in a homogeneous mixture of pure benzene and glacial acetic acid, and on being refluxed the lead compounds are converted to acetate which can be subsequently precipitated as lead chromate. By a suitable factor, the lead chromate is converted to the particular lead soap involved, *e.g.* lead chromate multiplied by 2·381 gives lead oleate. If it is desired to distinguish between the organically combined lead present as lead soap and the inorganic lead compounds, the sample is first refluxed with benzene. The latter are insoluble, and can be digested with nitric acid for the lead determination in the usual way. R. E. D.

174. Specifications for Lubricants. A. J. Gentil. *Chem. Weekblad*, 1934, **41**, 605.—The general requirements and the more narrowly defined specifications for special oils are given. The author criticises viscosity measurements of cylinder oil at 100° C., it being considered that the range 100–300° C. is more nearly representative of working conditions. For this purpose, Ubbelohde viscosity measurements are the more accurate. Although no method for the measurement of oiliness has been standardized, it is known that drastic refining removes the components of greatest oiliness. Compounded oils may be obtained by the addition of a very small fraction of ricinoleic acid in place of the much larger amounts of fatty oils required for the same purpose. The paper is concluded with a list of specifications for solid and semi-solid lubricants and greases. P. C. K.

175. Chart for the Classification of Winter Oils. R. Grosholz. *Nat. Petr. News*, 19.12.34, **26** (51), 32.—In the Chart, Saybolt Universal viscosities at 100° F. and 210° F. have been plotted against each other, and the limits of the viscosity specifications of a number of oils are marked on it. If the viscosity of an oil is known at those two temperatures, reference to the chart, therefore, classifies the oil according to the zone in which lies the point of intersection of line drawn through the points representing those viscosities. H. G.

176. Analyses of Crude Oils from some Fields of Southern Louisiana. A. J. Kraemer and E. L. Garton. *B. of Mines R.I.*, 3253, Nov. 1934.—Analyses of twenty-six representative crude oils from fourteen fields in the Louisiana Gulf Coast area are given. Large variations occur in the physical and chemical properties of the oils, the crudes being of naphthene, naphthene intermediate, and intermediate base. Tests on samples of crudes from the same field but at different depths indicate that as the depth increases

the base changes from naphthene to intermediate base, wax occurring in the crude at the lowest depths. In general, the miocene formations show heavy oils with little naphtha content, and the oligocene formations medium to high naphtha contents.
C. L. G.

177. Formation of Gum in Gasoline. P. Woog, J. Givaudon, and P. Dacheux. *Rev. Petr.*, 23.6.34 (584), 721–730.—An article describing experiments on the ageing properties of gasoline as measured by "actual" and "potential" gum determinations. Eleven different gasoline samples were examined, and their characteristics are given. Actual gum was determined by evaporation of 100 ml. portions contained in Pyrex dishes (10·7 cm. diam.) placed on a special type of constant-level water-bath. Above the water-level there was a perforated plate for removing water from the steam playing on the bath cover, which was provided with wells for the Pyrex dishes. The bath was covered with a glass bell resting in a water-sealed groove. Steam and gasoline vapours were drawn through a central chimney and concentric inner tube passing downward through the water-bath by an air ejector which maintained 20 mm. (water) vacuum in the evaporation space. The Pyrex dish containing the sample is heated for 3 hrs. in this apparatus, then dried in an oven for 6–8 hrs. at 160° if the residue is dry, or first for 2 hrs. at 100° if it is wet. The dish is then weighed after cooling. Tests have shown that gasolines containing not more than 10 mgm./100 ml. actual gum give no trouble in the engine. A simplified routine test consists of heating the same volume of sample for 2 hrs. in the apparatus, then drying at 160° for 1 hr. To simulate engine conditions atomised gasoline and air were passed through a horizontal aluminium tube (containing an aluminium strip wound to give a helicoidal surface) heated in an electric oven to 105–110°. An ejector at the exit end removed the vapours and maintained a vacuum of 20 mm. During 5 hrs. 1100 ml. gasoline were evaporated, and a definite relation was found between the gum formed and the "actual" gum.

In the experiments on "potential" gum, estimation of peroxides, acid treatment, refluxing with copper or aluminium powder, dichromate oxidation, and oxidation with oxygen under pressure in the cold gave unsatisfactory results. The Voorhees induction period method and the Voorhees–Eisinger gum test were next examined. The results from these methods showed some similarities, but the latter was regarded as more satisfactory, since it gave curves which indicated periods of slow and more rapid ageing. The effect of white light was investigated without profitable results. The effect of ultra-violet light was studied by exposing the gasoline in Pyrex flasks to a mercury vapour lamp (4·5 amp. 110 v.) at a distance of 30 cm. The results revealed a difference between gasolines not shown by the oxygen bomb test. After exposure to ultra-violet light the samples were tested in the bomb. These tests showed that the reaction of some of the gasoline constituents commenced only after less stable constituents had been attacked. This method of determining "potential" gum gave reproducible results when the gum did not exceed 10 mgm. For higher values the accuracy fell, being about 10%. Optimum conditions for this method were: exposure to ultra-violet light for 1 hr. followed by heating to 100° for 3 hrs. in the oxygen bomb. Copious data and diagrams are given. G. R. N.

178. Gum in Light Motor Fuels. R. Weller. *Öl und Kohle*, 1934, **2**, 527–531.—This paper was also read at the session entitled "Testing, Investigation and Nomenclature" of the German Institution of Mineral Oils held on April 28th, 1934. Various accelerators and inhibitors of gum formation are quoted, and methods of determination of gum in cracked spirits are described. Alcohol–benzole blends (10% alcohol) decrease the induction period of benzole by about 50%. The effect of induction period on storage is considered, but the induction period is not regarded as conclusive in gum determination. W. S. E. C.

179. Aviation Fuels and their Tests. A. Philippovich. *Öl und Kohle*, 1934, **2** (12), 531–537.—This paper was also read at the above-mentioned session. Spirit of 73–80 octane number is recommended for aviation engines and the difficulties of using ethyl fluid are given. Tests carried out by the A.S.T.M. Aircraft Fuel Research Committee are described, and the C.F.R. octane number and C.F.R. research methods are elaborated. W. S. E. C.

180. Solubility in Water and Boiling Points of Petrol/Alcohol Mixtures. F. Spausta. *Petr. Z.*, 12.12.34, **30** (50), 1–3.—The solubility of samples of Rumanian petroleum/

alcohol mixtures with 5–90% of alcohol by volume and the boiling range of the mixtures were determined, and the results tabulated. The water-solubility was determined by titration with distilled water from a microburette reading to 0·01 ml. until the mixture became turbid. The solubility of petroleum/alcohol mixtures in water is much less than benzine/alcohol, or even benzole/alcohol mixtures, since petroleum contains high molecular hydrocarbons the solubility of which decreases with increasing molecular weight. Organic liquids are arranged in the following order of solubility: paraffins, paraffin halogen compounds, cyclic hydrocarbons, ethers, esters, alcohols, carboxylic acids, and finally (inorganic) water. Any two liquids of this series may be separated from one another: the higher the mol. wt., the more easily do the layers separate, *e.g.* two layers form at room temperature in water/hydrocarbon, water/ether, water/ester, water/butyl or higher alcohols, acetic acid/paraffin, etc.

Unlike benzine/alcohol mixtures, petroleum contains no hydrocarbon which forms azeotropic mixtures with alcohols. Consequently alcohol present in these mixtures distils over almost completely at the b. p. of alcohol, whilst the remaining petroleum distils over much later. The final b. p. of petroleum/alcohol mixtures decreases even more with increasing alcohol content. W. S. E. C.

181. Catalytic Oxidation of Ethyl Alcohol. J. A. Patterson and A. R. Day. *Ind. Eng. Chem.*, 1934, **26**, 1276.—The catalytic oxidation of ethyl alcohol in the vapour phase over a silver catalyst has been studied at 1–50 atm. pressure and at 1 atm. over silver catalysts promoted with samarium oxide. It is shown that the total conversion decreases rapidly with increase in pressure. The promoted catalysts have the advantage of increasing the process yields of acetaldehyde, and permitting efficient operation at a somewhat lower temperature than the unpromoted catalyst.

W. H. T.

182. Significance of Light Translucency of Thin Adsorbed Films of Lubricants. S. Fischer and E. Marinoff. *Petr. Eng.*, July 1934, **5** (11), 20; August 1934, **5** (12), 36; Sept. 1934, **5** (13), 29; Oct. 1934, **6** (1), 54; Nov. 1934, **6** (2), 61.—Light translucencies are compared in an instrument described as an unctuometer. This is a type of photometer consisting of a tube divided into two, provided with screens at the top which are matched in light intensity. A uniform absorbent medium, such as filter-paper, is used for the test, a light of fixed intensity passing through the medium in one section, whilst in the other the light intensity of the lamp is controlled by a variable resistance, and is measured by the angle on the fixed disc registered by a pointer attached to a small gear wheel which actuates a larger wheel. The large wheel has a needle which moves along a resistance wire in the light circuit. A standard 5% solution of oleic acid in ether is prepared, and two drops are placed on the absorbent medium in the matching tube. When all solvent is evaporated, the filter paper is adjusted so that the light passes through the total film. For calibration, the difference in angle reading between the tests on the absorbent medium only and on the oleic acid film is taken as 100%. The test is then repeated on a 5% solution of the oil sample. Tests on numerous samples of Pennsylvanian, Mid-Continent and naphthenic base oils were related to the A.P.I. gravities, and to the viscosities S.U. at 210° F. of the oils. Generally speaking, it was found that with Pennsylvanian oils translucency increased with decrease in A.P.I. gravity or increase in viscosity, whereas the reverse occurred with the other types of oil. The Pennsylvanian oils range from 70 to 90% translucency, and it was observed that, with the exception of highly filtered varieties, there is a common point of intersection irrespective of treatment at 28·5° A.P.I. gravity and 81% translucency and at 63·8 secs. viscosity and 76% translucency. The other oils ranged from 35 to 65% in light translucency. Further results on Mid-Continent oils indicate that the test is capable of indicating the types of oil under test and the effect of a given treatment on the value of the oil. Subjection to prolonged heating or to a high degree of filtration appears to reduce the light translucency of Pennsylvanian oils.

Tests on Pennsylvania oils and specially treated clay filtered naphthene base oils show the former to lose considerably less in translucency during use in an engine than the latter. Pennsylvania oils of viscosity below 64 secs. show a much greater loss of translucency during use than those of higher viscosity, and also give greater carbon deposits on filtration after use.

Oils used in test runs of 500 and 1032 miles respectively were diluted with ether,

filtered, washed, and photographed. The filter-papers were further washed with xylol, CCl_4, acetone, and CS_2, and the carbon residue was again photographed. Judged by the pictured deposits, a specially treated naphthene base oil after 500 miles use broke down more than the Pennsylvania oils after the longer run. The specially treated naphthenic base oil showed a high initial translucency, but after heating at temperatures of 250–350° C. tended to lose progressively in translucency to a greater extent than the Pennsylvania oils, and to commence loss at a lower temperature. It is considered that stability of light translucency of an oil to heat is a measure of its durability in service. Two special processes have been devised to increase this stability to heat, their effects being more marked on naphthene base oils than on paraffin base oils. Other interesting conclusions are drawn from comparison of light translucency with (*a*) neutralisation number, (*b*) rate of spreading on a specific surface, (*c*) kinematic coefficient of friction. Further work is in hand in this connection.

R. A. E.

183. Results of Engine Tests using Motor Oils Manufactured by Solvent and Ordinary Methods. S. Born and E. Harper. *Oil & Gas J.*, 1.11.34, **33** (24), 12.—For the purpose of these tests nine oils were chosen. Five were acid and earth-treated Mid-Continent oils of varying viscosity, two were solvent-extracted Mid-Continent oils, one was a normal Pennsylvania oil, and the other was a solvent-extracted oil from asphalt base crude subsequently treated with acid and clay. The oils were tested in a Plymouth 6-cyl. engine for 40 hrs. at an engine speed of 2000 r.p.m., and in addition full load and friction tests were made. The total test was equal to about 1700 miles running on the road. The same gasoline was used throughout the series. Provision was made for measuring fuel consumption, cooling temperature, power output, frictional H.P., wear, etc. Conventional analyses of the oils were made before and after each test, and data regarding fuel consumption, power output, and frictional H.P. are tabulated. An analysis of the results shows that neither Conradson carbon value nor precipitation number of an oil bears any relation to carbon formation in the engine except when comparing oils of similar origin which had received similar treatment. There is no general relation between viscosity or flash-point and oil consumption, but there is a tendency for oils of low flash-point and viscosity to be consumed more rapidly. The lubricating value of an oil, as judged by the fuel consumption and friction tests, cannot be related to viscosity or carbon residue content. It is concluded that the service performance of an oil is greatly dependent on unavoidable differences in engine conditions, and cannot be accurately judged by the properties of the oil. The only sure method of determining the value of an oil is to make an engine test. The status of solvent refined oils is not clearly defined by the tests. One of the Mid-Continent solvent-extracted oils gave excellent results, but the other was amongst the least suitable of those tested. The asphalt base oil was ranked high in the list. Each of the three oils was treated by a different process, so that the performance of a solvent-extracted oil evidently depends on the type of crude oil used and also on the process employed, and is not necessarily superior to that of a high-grade Mid-Continent oil produced by present methods.

R. A. E.

184. Dispersion Analyses of Graphite–Oil Suspensions. L. W. Liutin and W. A. Kiriuschkin. *Petr. Z.*, 5.12.34, **30** (49), 1–4.—The concentration of suspended graphite is determined by filtration through a Gooch crucible filled with a bleaching earth which absorbs the oil, the oil being removed by washing with benzole, carbon tetrachloride, and chloroform. The authors have also used a porous Berlin crucible, the walls of which adsorb the smallest particles of graphite and resins. The results obtained by this method are therefore lower than those obtained by filtration through a Gooch crucible. Viscosity/dilution curves are prepared in order to facilitate the preparation of the dispersion medium of desired viscosity.

W. S. E. C.

185. Practical Evaluation of the Ignition Characteristics of Diesel Fuel Oils. C. C. Moore and G. R. Kaye. *Oil & Gas J.*, 15.11.34, **33** (26), 108.—The ignition lag of a fuel in a Diesel engine running at constant speed is expressed as a "delay number," *i.e.* the number of degrees the crankshaft rotates in the interval between the beginning of fuel injection and the moment of fuel ignition. The apparatus used was a modified C.F.R. Diesel conversion unit. The inlet air is supercharged and heated to 260° F., an air deflector attached to the inlet valve to increase turbulence, and the piston head altered to permit the use of higher compression ratios without fuel-spray interference.

An electrical device indicates the degrees of crankshaft angle in relation to T.D.C. when the nozzle plunger opens to admit fuel to the combustion chamber. A balanced diaphragm unit is used for measuring combustion-chamber pressure at any point in the engine cycle by a special electrical method of recording, and by including a selector on the crankshaft in the circuit. In this device the gas pressure in the chamber operates on a diaphragm, and is opposed by pressure from a nitrogen cylinder, which can be measured by means of a gauge. Engine conditions utilised are detailed, and were selected to give good reproducibility and correlation with a commercial engine.

Pressure-time diagrams for a number of fuels in the test unit and in a 75-H.P. 3-cyl. commercial Diesel engine are plotted over the significant portion of the cycle. The accuracy claimed at any point is 4 or 5 lb. pressure. There are differences between the two sets of diagrams, but, generally speaking, a reasonable similarity exists, and the fuels are placed in the same order in regard to delay numbers and peak pressures. Tests were then carried out on blends of cetene produced in the authors' laboratories with α-methylnaphthalene in order to relate delay number to cetene value under the specified conditions of test. The general properties and cetene values of thirty-two samples of oil of diverse origin and ranging in viscosity from 34 to 257 S.U. at 100° F. are tabulated. The results tended to show that cetene value increased with paraffinicity. Viscosity–gravity constants of the oils were therefore determined. Since Hill and Coats formula is not accurate for oils of viscosity below 50 secs. S.U. at 100° F., it was modified as a result of experimental evidence to: $G = 1{\cdot}082A - 0{\cdot}0887 + (0{\cdot}776 - 0{\cdot}72A)(\log\log(KV - 4))$, where G = s.g. at 60° F., A = viscosity–gravity constant, KV = kinematic viscosity in millistokes at 100° F. This formula is believed to be accurate for viscosities within the working range of the Saybolt instrument. When the relationship between cetene value and viscosity–gravity constant is plotted on a graph, a smooth curve results. The maximum deviation for any oil tested is about 2 cetene numbers. A nomographic chart was then prepared to permit the cetene value of an oil to be ascertained from a knowledge of the viscosity S.U. at 100° F. and the A.P.I. gravity at 60° F. The values given are said to correspond closely with carefully performed engine ratings. The application of the table may be limited to typical petroleum hydrocarbons, and the data are not necessarily valid for synthetically prepared or doped fuels. R. A. E.

186. Heavy Oils. A. J. Gentil. *Chem. Weekblad*, 1934, **41**, 639.—In this article the heavy oils are classified as:

(1) heavy kerosines for Diesel engines and heating systems; (2) gas oils and solar oils for different types of combustion engines and central heating furnaces; (3) dark-coloured fuel oils and coal tar for combustion purposes. Some types, covering special requirements, are used in Diesel engines.

A comparison is given of fuel oil in contrast with coal including thermal yield, consistency of quality, flexibility, smoke and ash, transport, etc.

Several tables dealing with conditions of supply for marine and commercial use in various countries are given. P. C. K.

187. Colour of Asphaltic Bitumen. E. Graefe. *Bitumen*, 1934, **4**, 219–221.—Petroleum bitumens and natural asphalts differ considerably in colour, as shown by the inspection of thin layers of the material, *e.g.* melted on glass or the film left by the evaporation of a solution of the bitumen in benzole. The colours vary from light brown to black, and in order to obtain a record of the colour, a method is proposed for comparing the colour of 5 ml. of a solution of the bitumen in benzole (1 in 10,000) with an aqueous iodine solution (0·1% iodine, 0·2% potassium iodide). This solution is added from a burette to 5 ml. of water until the colours match when compared in identical flat-bottomed cylindrical vessels. Seven petroleum bitumens, three natural asphalts, and one bleached asphalt (prepared by treatment of a bitumen solution with sulphuric acid followed by earth filtration) have been examined, the iodine required for matching varying from 0·15 ml. for the bleached bitumen to 2 ml. for a blown bitumen. The latter are always darkest in colour, whilst the natural asphalts are lightest, partly owing to the mineral content. Petroleum bitumens prepared by a distillation method may be darkened in colour by the manufacturing process. For the preparation of coloured products containing asphaltic bitumens, the latter must be of the lighter shades of colour if satisfactory results are to be obtained. For this reason natural asphalts are widely used for this purpose. The bleached bitumen is a special product—too expensive for general use. C. C.

188. Mechanism of Adhesion (of Bitumen to Stone). W. Riedel. *Asphalt u. Teer*, 1934, **34**, 924–926, 941–943, 961–963, 979–980 (cf. Abstr. Nos. 770, 1266, 1934).—When a solid is wetted by a liquid, adsorption occurs at the surface followed by chemical reaction between the adsorbed material and the constituents of the solid phase. Polar molecules with different active groups show varying wetting characteristics owing to the different chemical reactions involved. A number of experiments were carried out with $MgCO_3$, $CaCO_3$, Fe_2O_3, and Al_2O_3 (all of which are common constituents of minerals) and spindle oil. The finely-divided mineral (mesh 10,000/sq. cm.) was mixed with spindle oil of known acidity to form a paste. After 1 hr. contact, the oil was filtered out as far as possible, and the acid number of the oil determined. The residual solid contains adhering oil, adsorbed naphthenic acids, and/or soaps. By a series of extractions with benzine, water, and alcohol, water-soluble and -insoluble soaps were separated. The results show that $MgCO_3$ and $CaCO_3$ are more reactive than Fe_2O_3 and Al_2O_3. The former after extraction are not wetted by water, owing to the presence of a strongly adsorbed layer of acid or soap.

(Mineral oils nearly always contain iron due to the action of the oil on the containers, whilst rock asphalt after exhaustion with benzole gives a residue not wetted by water and from which a brown oil can be extracted with alcohol. This is saponifiable, and contains calcium. A compound of calcium and the asphalt acids is present at the surface of the mineral. It is concluded that the mineral content of bitumens consists of Ca, Fe, and Al in the form of salts of acids or double compounds similar to the $FeCl_3$–asphalt compound described by Marcusson.)

For an oil to show good adhesion to a solid, the former must contain acid or polar compounds; both oil and stone must have definite chemical properties, *e.g.* quartz —an acid stone—cannot react with an acid oil. Basic oxides, on the other hand, react with acid oil, and are hydrophobic. Metals, silicon, carbon, carbonates, and sulphide earths are all hydrophobic, but all sulphates are hydrophilic.

One condition necessary for adsorption which depends on the chemical reaction is that the rate of solution of the mineral must be less than the rate of formation of the reaction product.

The wetting characteristics of stones and silicates are governed by the ratio of acid to base. Clays, for example, where the proportion of silica to base is approx. 2 : 1 are hydrophilic. Such clays, *e.g.* bentonite, which therefore show bad adhesivity for bitumen, are used as emulsifiers.

It is considered that the DIN 1995 method of taking the total Al_2O_3 content of a mineral as an indication of clay content is not accurate.

The general conclusion is that aggregates which show hydrophobic properties towards mineral oil or bituminous binder contain an excess of basic constituents. Hydrophilic properties are always shown when the ratio of acid to base is >1. Hydrophobic materials react with the polar molecules of the wetting liquid, forming water-insoluble compounds, but the latter are soluble in the wetting phase. Hydrophilic materials, on the other hand, either undergo no transformation in contact with the liquid phase or water-soluble compounds are formed. C. C.

189. Fluorescence Spectroscopy as an Aid to the Examination of Bitumen. Anon. *Petr. Z.*, 21.11.34, **30** (47), 1–3.—The application of absorption and emission spectra for the solution of geochemical problems is dealt with. It is shown that the content of sulphur and its compounds can be determined by means of normal absorption band technique. Examples are given of the correlation of the oil content of oil shales by means of spectroscopy and the application of the spectrograph to the origin (animal or plant) of petroleum, waxes, and asphalts. A study of previous work on this subject leads the author to suggest that the formation of petroleum is a distillation process, and he cites as examples burnt shales of Estonia and of the Cambrian and Silurian strata of Devon. Finally, comment is made on the connection between the vanadium content and the source of petroleum. W. S. E. C.

190. The Work of Prof. I. Mościcki in Petroleum Technology. K. Kling and W. Leśnianski. *Przem. Chem.*, 1934 (10–12), 231–266.—The authors give a systematic description of the work and patents of Prof. I. Mościcki in petroleum technology.

The following four sections are distinguished in the review: (1) work on the problem of separating natural petroleum emulsions; (2) work on conservative distillation; (3) work on the preparation of gasoline from natural gases by absorption

methods; (4) other works, such as on the chlorination of methane, the extraction of wax, the pyrogenetic decomposition of petroleum hydrocarbons, etc. E. F.

Class 600. Refining and Refineries.

191. Progress of Petroleum Industry in Poland. J. Klipper and E. Holzman. *Przem. Chem.*, 1934 (10–12), 434–441.—In the first part of the paper new research methods for the study of petroleum products are discussed, and certain operating advances developed in Poland are described. The second part treats of the refining procedures of Polish petroleum products, with special reference to transformer, turbine, and cable oil, road-surface asphalts, and certain by-products. E. F.

192. Emulsions Treated at Low Cost. J. W. Smith. *Petr. Eng. Dec.*, 1934, **6** (3), 29.—At a refinery at Waterloo, Arkansas, three large high-capacity National Oil-Rator emulsion treaters have been installed to treat crude of water content 15–45%. Chemicals are first added to the crude, followed by heating with gas fuel to 210–220° F. 60% of the water is separated at this point and the remainder flashed off by heating to 240° F. in a further heater unit. The first section of the heater is kept full of water, so that the entering emulsion percolates through it. A B.S. & W. content of the treated crude of 0·4–1% is obtained. Operating costs average 2·3 c. per brl. of treated oil, compared with 8–12 c. for more usual types of treater. No additional labour is required to operate the treater, whilst investment and maintenance costs are low. In spite of the corrosive nature of the crude oil and salt water, only a slight rust coat is formed, whilst, owing to the sectional construction, the plant is easy to take apart and reassemble or modify. Cleaning is simplified by the presence of convenient openings, rendering the entire interior accessible. C. L. G.

193. Effect of Entrainment on Plate Efficiency in Rectification. F. H. Rhodes. *Ind. Eng. Chem.*, 1934, **26**, 1333.—Equations are developed to express the effect of a known amount of entrainment, at known reflux ratio, on the efficiency of a fractionating plate when distilling a binary mixture. It is assumed that the number of mols. entrained from any plate is constant throughout the column.

It is shown that if E is the number of mols. entrained per unit time, the efficiency of a plate drops from 1 to $1/1 + E$ at total reflux, and from 1 to $R/[R + E(R + 1)]$ at reflux ratio R. The rate of distillation is such that 1 mol. of distillate is produced in unit time. The results obtained may be introduced into the graphical method of McCabe and Thiele by a simple adjustment of the operating line.

The effect of entrainment when conditions are such that the vapour is not in perfect equilibrium with the liquid is discussed, and it is shown that the approximate amount of entrainment can be calculated by measuring the plate efficiency at various reflux ratios.

The effect of entrainment in the exhausting column is also discussed. P. D.

194. Refining Persian Crude Oil. G. Egloff and E. F. Nelson. *Oil & Gas J.*, 27.12.34, **33** (32), 73.—The results of topping and cracking Persian crude oil in a Dubbs pilot plant are given. Topping the crude oil gave the following products: Light gasoline (250° F. E.P.) 16·4% by vol., naphtha (400° F. E.P.) 18·7%, and topped crude 62·3%. The combined distillates had an octane number of only 54, so that cracking of the naphtha and topped crude was effected. These products gave yields of cracked gasoline of 11·4% and 33·5% respectively (on the crude). A total yield of 61·3% by vol. of blended gasoline of O.N. 70 is thereby obtained. The cracked gasoline required treatment with 1 lb. of 93% H_2SO_4 per brl., followed by neutralisation with NaOH and redistillation. 0·025% of Universal inhibitor is added in order to increase the oxygen bomb stability induction period from 125 to 620 mins. The cracked gas consisted of 72·8% paraffins, 5·4% C_2H_4, 18·2% C_3H_6, and higher olefines, 2·6% H_2 and 1·0% of CO_2, CO, O_2, and N_2.

The residuum from cracking the topped crude had a cold test of 60° F., B.S. & W. of 0·2%, and visc. S.F. of 1170 secs. at 122° F.

A flow sheet giving yields from the crudes and full analytical data on the products are presented. C. L. G.

195. Iraq Crude. G. Egloff and E. F. Nelson. *Oil & Gas J.*, 27.12.34, **33** (32), 92.—A brief history of the development of the Mesopotamian oil-fields is presented and data

are given on the properties of crude oil from the Kirkuk field. The main fields are at Quiyarah, Kirkuk (Baba Gurgur), and Neft Khaneh. The Quiyarah crude resembles heavy Mexican crude, whilst Kirkuk crude is sulphurous and of mixed base, resembling Mid-Continent crudes.

Topping the Kirkuk crude gave 26·8% of gasoline of 395° E.P. of gravity A.P.I. 64·0, S. 0·08%, O.N. 50, with 32% dist. to 100° C. The reduced crude on cracking in a Dubbs unit gave 41·2% and 44·2% of gasoline (at different operating temperatures). The latter type of gasoline had the following properties:—Grav. A.P.I. 60·2, Colour 17 Saybolt, Gum (copper dish) 40 mgm./100 ml., sulphur 0·31%, O.N. 67, I.B.P. 94° F., 35% to 214° F., & E.P. 382° F. Various types of refining were given to the cracked gasoline resulting in improvement of the colour to 30 Saybolt, a neg. doctor test, gum content of 5–11 mgms. (without U.O.P. inhibitor) and 2–5 mgms. (with inhibitor), Oxygen bomb stability of 55–120 mins. induction period was increased by refining to 225–840 mins. The sulphur content of the refined gasoline was reduced to 0·12/0·21 and the O.N. to 64/65. The cracked fuel oil had a cold test of 40/48° F., B.S. & W. 0·3%, and Visc. S.F. at 122° F. of 240/388 secs. C. L. G.

196. Cracking Unsaleable Paraffinic Gas Oil. F. L. Martin, C. H. Alberding, and B. J. Flock. *Oil & Gas J.*, 13.12.34, **33** (30), 36. The refinery concerned was producing 1200 brl. a day of waxy gas oil from Allen, Oklahoma crude, unsaleable on account of its high pour-point. The gasoline produced was deficient in light fractions, having an I.B.P. of 150° F., and therefore had to be blended with natural gasoline. It was therefore decided to instal a Dubbs unit suitable for cracking waxy distillate or fuel. The properties of the waxy distillate were: Pour-point 100° F., 1% over at 572° F., 22% over at 700° F., viscosity S.F. at 122° F. 26 secs. On cracking to produce gasoline of 400° F. E.P. (Octane No. 69 by C.F.R. Motor Method), the yields obtained were: 53·19% vol. of gasoline having I.B.P. 85° F. and 10% over at 150° F.; 36·44% vol. of residue having viscosity S.F. at 122° F. of 90 sec. and pour-point 45° F.; gas and loss 10·37% vol. By reducing the E.P. of the gasoline to 380° F. the throughput was raised from 1455 to 1942 brl. a day. The yields and properties of products then obtained were: Gasoline, 40·95% vol. having I.B.P. 82° F., 10% over at 140° F., octane rating 72 C.F.R. Motor Method; Furnace oil, 12·1% vol. having a boiling range 381–510° F. and pour-point 0° F.; residue, 37·4% vol. having viscosity S.F. at 122° F. of 59 sec. and pour-point 40° F.; gas and loss 9·55% vol. The gasolines as produced are satisfactorily sweetened and treated with an inhibitor. A description of the unit is given. R. A. E.

197. Three Charging Stocks Cracked in a Dubbs Unit in Continuous Operation. G. Egloff and E. F. Nelson. *Nat. Petr. News*, 26.12.34, **26** (52), 22.—Flexibility in operation is of great importance in cracking units where the charging stock is of widely differing nature. That the Dubbs Unit is flexible has been demonstrated on one plant in which naphtha, gas oil, and petrolatum have been treated successively without interrupting working. The unit was operating to produce a gasoline of 70 octane number (motor method). With the petrolatum the "re-cycle" system was adopted, but the gas oil and naphtha were treated once only, the bottoms being run to storage. The naphtha gave a yield of 78·1% gasoline with a total loss of 16·4%. H. G.

198. Cracking of Heavy Primary Tars with $AlCl_3$. I. E. Zudilov. *Khim. Tverdogo Topliva*, 1932, **3**, 129–135.—The fraction >260° C. of primary tar from Barzas sapropelite was separated into:

(1) Heavy fraction 265–350° C., freed from paraffin and phenols,
(2) ditto freed of phenols,
(3) ditto as separated.

These, together with (4) primary tar 55–350° C. freed of phenols, (5) primary unrefined kerosine, 201–270° C. and (6) pure paraffin, were separately treated with 10–15% $AlCl_3$, and the yields of fractions boiling between 60° and 310° C. were (1) 40, (2) 70·5, (3) 45·5, (4) 61, (5) 66·4, and (6) 68·1%. The products were very stable, and did not need any, or only a slight, treatment. For. Petr. Techn.

199. Scottish Shale Oil Industry. Anon. *Chem. Trade J.*, 1934, **95**, 226.—The output of shale oil in Scotland in 1933 was 1,397,000 tons, an increase of 31,000 tons over 1932. 30 million gallons of crude shale oil and crude naphtha and 24,950 tons of sulphate of ammonia were produced, the yield of liquid refined products being slightly in excess of the 1932 yield. C. L. G.

200. High-pressure Hydrogenation. N. Klyukvin, F. Voronov, and M. Preis. *Khim. Tverdogo Topliva*, 1932, **3**, 135–146.—The hydrogenation apparatus consists of a receiving vessel, reaction chamber, and discharge vessel. The receiving vessel for the hydrogenation stock is equipped with an electromagnetic feed device for the adjustment of velocity of feed. It is provided with a pressure gauge and a gas-discharge opening. The reactor is placed at an incline towards the outlet and is electrically heated. Its outlet is connected with the discharge vessel through a joint equipped for the admission of hydrogen and the thermocouple. The joints are ground, and have a copper gasket. A gas oil, sp. gr. 0·887 and boiling range 230–330° C., was used in the hydrogenation, which was carried out with the reactor charged with Ni shavings and at a feed velocity of 340–2000 ml./hr., a constant pressure of 200 atmos., and a temperature ranging from 270° to 500° C. The hydrogenated product was topped to 230° C. and the residue recycled several times. Best results were obtained at 480° C. and a feed velocity of 8 ml./min., whilst the gasoline yield in a once-through operation should not exceed 26% if it is desirable to avoid formation of gases and carboids. It is best to preheat the stock, particularly if using high pour-point fuel oil. The sp. gr. of the recycle stock should not exceed that of the original feed to any noticeable extent, when the formation of coke, asphaltenes, and gas should be avoided. Full details are given. For. Petr. Techn.

201. Formation of Carboids in Catalytic Hydrogenation. I. S. Diner and M. S. Nemtzov. *Khim. Tverdogo Topliva*, 1932, **3**, 727–733.—After giving a critical review of the existing methods for the determination of carboids, the following procedure is recommended. The used catalyst is burned in an elementary analysis furnace after a preliminary benzole extraction and drying. In addition to the determination of carbon, a determination of the increase in weight of the vessel plus catalyst was made. This permitted the determination of oxygen, which combined with the inorganic part of the catalyst during the combustion. The hydrogenation conditions have great influence on the type of carboids formed. Thus, with the increase of the hydrogen pressure the amount of carboids decreases and their content in hydrogen increases. The carboids are more saturated with a lowering in the reaction temperature. A decrease in the amount of hydrogen used in the hydrogenation lowers the efficiency of the latter, whereby a greater amount of carboids is formed and they are lower in hydrogen content. The experiments are described and the results tabulated.
For. Petr. Techn.

202. New Methods for Refining Lubricating Oil. R. Fussteig. *Erdöl u. Teer*, 1934, **10**, 415–418.—After reviewing the familiar sulphuric acid method, the author describes a development of this wherein oil and acid are pumped separately into a vertical mixing chamber fitted with rotating pipes. The operations are continuous, and the proportion of acid is automatically regulated, whilst the separation of oil from acid-tar is effected by centrifuge. Oil and acid losses are minimised in this method.

A process is then outlined for which continuity with extreme simplicity is claimed. In this, oil in the form of a spray is pumped in at the bottom of a specially shaped vessel containing the acid. The refined oil escapes via an overflow pipe at the top, the acid-tar being drawn off at the bottom of the vessel.

The article concludes with a survey of the caustic-soda treatment. Gurwitsch is quoted as stating that sulphonic acids are responsible for emulsion formation. Naphthenic acids are purposely added to increase interfacial tension between oil and lye, and so reduce emulsion troubles. Hydrolysed soaps, naphthenic acids, and resinous compounds are effectively removed by earth treatment. The author considers that different oils require different earths, and states that a mixture of earths is more effective and economical than a single variety. J. L. T.

203. Transformer Oils from Russian Crudes by the Edeleanu Process. N. Calantar. *Erdöl u. Teer*, 1934, **10**, 447–450.—In this article the author claims that transformer oils equal in quality to the products of the usual sulphuric acid process, and also to Edeleanu products from other crudes, can be produced from the various Russian crudes by the Edeleanu process.

Comparative results obtained by the German, Swiss, and Italian methods of testing are given in support of this claim.

Discussing the article, Frank writes directing attention to his earlier publication

(*Erdöl u. Teer*, 1930, **6**, 357, 375, 392), and observes that the Edeleanu process produces good quality oils from any crude. J. L. T.

204. Specific-gravity System for the Maintenance of the Quality of Fuller's Earth. A. L. Shepard. *Refiner*, 1934, **13**, 423–425.—Stating that the common cause of the falling off of the decolorising power of clays after each burning is the incipient fusion which occurs, the economic advantages attaching to the use of a proprietary concentrating table operating on an air-flotation principle—and manufactured by Sutton, Steele, and Steele Inc., are discussed. The machine removes the inert material of higher density produced by burning. It is shown that the application of the method led to an earth after the tenth re-burning of the same decolorising quality as in the absence of re-processing would attach to the earth after the second burning. B. C. A.

205. Activation of Bleaching Earth. O. Eckart. *Angew. Chem.*, 1934, **47**, 821–822.—Activation may be carried out by treatment with 10% hydrochloric acid, but traces of the latter and chlorides of aluminium and iron remain in the earth. It is suggested that decomposition of aluminium oxide causes an enlargement of the surface, although it has been postulated (*Angew. Chem.*, 1934, **47**, 543) that the effect of the acid is to displace the exchangeable base with hydrogen. The effect of earths activated by electrodialysis was found to be no better than that of the crude earth. L. S.

206. Solutions of Gases as Selective Solvents. M. Goddewicz and S. Pilat. *Przem. Chem.*, 1934 (10–12), 376–385.—A new method for separation of mineral oils into fractions of different properties is described.

The fractionation is accomplished by saturation of solutions of crude petroleum, petroleum residues, lubricating oil distillates, etc., in light hydrocarbons with gases under pressure.

The Polish patent of the Institute for Chemical Research of 1920, which refers to a method of precipitating asphaltic substances from petroleum products by hydrocarbons boiling at below room temperature, has been chosen as a starting point for this investigation. By the use of commercial propane as a solvent precipitating asphalts, and by subsequent saturation of this solution of petroleum residues with methane or natural gas at suitable pressure, the effect of lub-oil fractionation can be attained. This effect may be modified by regulating the pressure of the gas, the nature of the solvent, etc.

One of the physico-chemical characteristics of this gas-solvent process is that by the use of methane those fractions are precipitated, forming a new liquid phase, which represent bad solvents for methane. The resultant conclusion that an analogous effect is to be expected in the event of hydrogen application has since been confirmed by experiments.

A noticeable increase in the volume of the solution has been observed at higher pressures, this phenomenon, which is of practical importance, being accounted for by an increased solubility of methane. A feature of some interest is that for the first time a number of different oil fractions has been prepared at room temperature without the application of heat and chemicals. Furthermore, these cold-fractionated lub-oils have a better colour and transparency and a better Visc. Index than oils obtained from the same crudes by distillation and acid treatment. E. F.

207. Naphthalene as a Means of Dewaxing and Cresol as a Selective Solvent. E. Katz. *Przem. Chem.*, 1934 (10–12), 408–419.—A description of researches and experiments performed in 1927–1929 is given. The first part deals with dewaxing of residues and distillates from Borysław crude, using a high vacuum distillation still. Such paraffin stocks, even when diluted with solvent naphtha, cannot be filtered on the usual filter presses. To make filtration possible, naphthalene was added to the warm paraffin oil distillate; on cooling, the naphthalene crystallises out, forming a spongy mass which retains the separated wax.

Cresol was next taken for dilution in place of kerosine in the above process; the lubricating oils so obtained had a lower freezing-point. Cresol was also used for dewaxing without naphthalene, as follows: The oil was mixed with cresol in the appropriate porportion, the mixture was cooled, and separated by filtration or centrifuging (solvent dilution). Alternatively, the mixture was separated into two layers,

of which the lower, dark-coloured one was free from wax, which was present with the refined oil in the upper layer (true solvent extraction).

Some successful experiments were carried out on the selective extraction of asphalt-base oils. E. F.

208. High Viscosity Index Blended into New Crankcase Oils. Anon. *Nat. Petr. News*, 14.11.34, **26** (46), 30.—The use of a new synthetic *iso*paraffinic material for blending with crankcase oil is said to produce a marked improvement in the viscosity index of the blend. The new material "Exanol" is produced by the polymerisation of the light ends of refinery gasoline. Exanol is clear and colourless, of a molecular weight and consistency dependent on the method of manufacture. Other desirable characteristics imparted to the blend are said to be: lower consumption, easier cold-starting, lower carbon and sludge-forming tendencies, and excellent piston seal. The other commonly measured physical properties of the blend are said to remain essentially unchanged. H. G.

209. Tin Compounds as Antioxidants in Lubricating Oils. E. W. J. Mardles. *Chem. Trade J.*, 12.10.34, **95**, 256.—Many metallic compounds appear to accelerate the rate of oxidation by air of lubricating oil. Some organic compounds have been found to behave as antioxidants, but at high temperatures their value is reduced. Of the metals examined, tin alone showed strong antioxidant properties, as also did some tin compounds, particularly at temperatures below 250° C. In general, the effect varied according to the compound used, type of oil tested, concentration, and conditions of experiment. Decreased oxidation was accompanied by less sludging, lower viscosity increase, less gum deposition, and general longer life of the oil. Suitable tin compounds for lubricating oil were the soluble fatty acid salts, naphthenates, phenolates, and organic metallic derivatives, such as tin tetraphenyl and tin naphthyl. Fine suspensions or colloidal dispersions of the dust, tin dioxide, etc., may be serviceable in some cases, *e.g.* journal bearings.

The reduced acid values of the oil in the presence of tin suggests that the tin derivatives are capable of reacting with, and destroying or reducing, an active catalyst produced by the oxidation of the oil itself. C. L. G.

210. Lubricating Oil from Tar. Anon. *Petr. Times*, 8.12.34, **32**, 616.—The results of experiments in the preparation of lubricating oils from coal derivatives carried out at the Fuel Research Station are described. Low-temperature gas and tar spirit, after suitable refining, was refluxed at 78° C. over 7% wt. aluminium chloride for 12 hrs. After refluxing, the spirit was washed with caustic soda and water and topped at 220° C. Analysis of the spirit before and after refluxing showed that the content of unsaturateds had fallen from 32·0% to 1·3%, with a proportional increase in the content of saturated hydrocarbons. The residue after topping was distilled with superheated steam under reduced pressure to give four grades of viscous oil, together with some "middle oil" of Diesel fuel type. None of the viscous oils was of good quality. All had poor viscosity indices and resistance to oxidation.

In further experiments cetyl benzene and cetyl *cyclo*hexane have been prepared by cracking and subsequent polymerisation. These bodies have displayed reasonable resistance to oxidation, and they do not lose viscosity very rapidly with rise of temperature. Their absolute viscosities are low compared with those of petroleum oils. They are not, however, suitable for use as lubricants, since they are low-melting-point solids. H. G.

211. Dewaxing Pennsylvanian Oil with Propane. R. C. Conine. *Oil & Gas J.*, 20.12.34, **33** (31), 17.—At a meeting of the Pennsylvanian Grade Crude Oil Association, a paper on this subject was presented by P. C. Keith.

On dewaxing a typical Pennsylvanian long residuum of 74 sec. visc. S.U. at 210° F. by diluting with propane, allowing the propane to evaporate until the temperature reached − 40° F., and continually removing the wax on a rotary type filter, a yield of dewaxed oil of 80·6% by vol. was obtained. The pour-point was reduced from 70° F. to − 12° F., whilst visc. and Conradson carbon value remained practically unchanged. This also indicates removal of asphaltic matter, and was confirmed by a 50% increase in filter yield of oil of a given colour. By treatment with varying concentrations of propane and by varying the temperature between 120° and 160° F. in four stages, a Pennsylvanian residuum of 172 visc. S.U. at 210° F. can be fractionated into primary

and secondary resins (8·2%) of high viscosity and Conradson carbon value; a light blending stock (72·3%) having a visc. S.U. at 210° F. of 121 sec. and low Conradson carbon value; and a cylinder stock (17·3%) of 235 sec. visc. having a Conradson carbon value similar to the original charge. Filter yields are increased by 100/800%, as compared with the original charge, depending on the final colour desired and the amount of material extracted. Since the extracted material has a very high viscosity, it is possible to increase the viscosity of the residuum for treatment, so that the yield of neutral oils from the crude can be substantially increased. In addition, the cost of filtering the residuum, which is at present 3/6 cents per gal., can be substantially reduced. Comparative estimates of charges and credits when treating a 20% Pennsylvanian residuum (on the basis of 3000 brl. crude intake a day) by current methods and by the propane de-resinating method, show the latter to be the more profitable. A flow sheet of the de-resinating process is provided. R. A. E.

212. Use of $Fe_2(SO_4)_3$ for Paraffin Refining. Z. Z. Biluchowski and R. Dobrowolski. *Przem. Chem.*, 1934 (10–12), 309–313.—The results of numerous experiments carried out in the laboratory and under factory conditions show that the use of $Fe_2(SO_4)_3$ for paraffin refining can successfully replace sulphuric acid now generally used for this purpose. One of the outstanding advantages of the above-mentioned refining process is that odourless paraffin is obtained. The application of this method to refinery practice is not at present possible, owing to the high price of $Fe_2(SO_4)_3$. E. F.

213. Heat Exchangers. Anon. *Rev. Petr.*, 30.6.34 (585), 761; 7.7.34 (586), 781; 21.7.34 (588), 885, and 28.7.34 (589), 917.—In the first article the heat-transfer coefficient K is derived, giving a graph for determining the logarithmic mean temperature, as well as graphs showing the variation in temperature on con-current and counter-current heat exchangers. The influence of the velocity and viscosity of the fluids is also shortly discussed.

The second article is devoted to the evaluation of K, taking petroleum products as the heat-exchanger fluids, and graphs are given of the variation with temperature of their densities, viscosities, specific heats, and thermal conductivities.

The third and fourth articles are devoted to the discussion of the various types of heat exchangers, condensers, preheaters both in former use and in the present day. G. R. N.

214. Heat Loss through Crude Oil Heaters. O. Krebe. *All. el. Fett. Ztg., Mineralöle*, 1934, **7**, 460–467.—The amount of oil required for heating a furnace is about 1·5% of the throughput. In one case, a heat loss of 920 kg.-cal. per sq. mh. was reduced to one of 455 kg.-cal. per sq. mh. by placing a 10 cm. layer of diatomite between the external wall and the inner lining. Using a 10-cm. sand layer, the roof loss amounted to 1358 kg.-cal. per sq. cmh., whilst with a 20-cm. layer the loss was 972 kg.-cal. per sq. cmh. L. S.

215. Patents on Refinery Plant. E. A. Barbet. E.P. 419,849, 20.11.34. A distillation apparatus operating at moderate pressure, in which the various fractions are drawn off in the liquid state from the reflux. The heavier of these fractions are allowed to expand, and the evolved vapours are condensed separately. The heavier portion is also collected separately, the lighter fractions of the rectification however are simply condensed and collected.

G. N. Haden & Sons and P. H. Herring. E.P. 419,949, 19.11.34. A liquid fuel burner in which fuel and air or steam are introduced tangentially into a mixing chamber where the fuel is initially atomised. The rotating mixture is discharged from an orifice adjacent to another, which directs a stream of air or steam against the discharging mixture, thus effecting further atomisation after the fuel has left the burner.

L. L. Rebber. U.S.P. 1,979,639, 6.11.34. A tubular still construction for heating and cracking oil.

E. W. Gard and P. Subkow. U.S.P. 1,980,330, 13.11.34. A radiant heat furnace, the radiation being from a thin sheet of incandescent gas.

G. B. Coubrough. U.S.P. 1,980,612, 13.11.34. Distillation apparatus for heavy asphaltic oil. The asphaltic residue is stripped by means of a heat storage medium to give sufficient amorphous wax in the single overhead distillate to permit entire wax removal by a single centrifuging operation.

T. C. Tifft. U.S.P. 1,981,128, 20.11.34. An oil heating furnace particularly suitable for cracking operations.

T. C. Whitner. U.S.P. 1,981,818, 20.11.34. Apparatus for counter-current treatment, comprising a tower formed of superimposed sections, with the bottom of each section connected to the central portion of the top of the next lower section. The reagent is introduced at the top of the tower and the oil at the bottom.

J. H. Tucker and J. N. R. Hannam. E.P. 420,461, 3.12.34. A method for preventing the rusting of ferrous metals in which, after subjection to the phosphoric-acid bath, the metal is immersed in a bath of oil containing colloidal graphite.

H. S. Blackwell. E.P. 420,197, 27.11.34. A pipe coupling comprising a union having an internally screw-threaded bore or socket for receiving the externally screw-threaded sleeve of a clamping bush. The front end of the loose packing ring, which is rounded or of reduced thickness, contacts with a substantially conical shoulder, both ring and shoulder being of such a shape that the front edge only of the ring is contracted on the wall of the pipe. W. H. T.

S. G. Cantacuzene. D.R.P. 598,970, 31.1.32. Apparatus for measuring the height of a heavy fluid in a reservoir. L. S.

F. W. Siepke. D.R.P. 600,540, 20.10.32. A frame for filter presses. Structural details are given. L. S.

216. Patents on Cracking. A. L. Mond. E.P. 420,115, 26.11.34. A process for the simultaneous treatment of solid bituminous material and heavy oil to produce low-boiling-point oil and to devolatilise the bitumen. The latter, dispersed in the oil, is heated, and passed to a reaction zone where the mixture in a thin film is brought into contact with a heat-carrying medium.

O. Behimer. U.S.P. 1,979,437, 6.11.34. Oil is subjected to cracking conditions and passed to a reaction chamber, the upper part of which is heated by hot gases in order to maintain separated vapours at cracking temperature. Unvaporised oil is withdrawn from the unheated bottom of the chamber.

L. C. Huff. U.S.P. 1,979,550, 6.11.34. Apparatus for the removal of carbonaceous deposits from reaction chambers, etc. Flexible metal spirals are positioned in the chamber, and at the end of the cracking operation are forcibly withdrawn, bringing with them the carbonaceous deposit.

J. G. Alther. U.S.P. 1,979,521, 6.11.34. Oil is cracked in a plurality of converters, the products being subjected to reflux condensation in separate zones. Cooling of the vapours is by means of cool charging stock, and the reflux condensate is passed to a separate conversion unit for recycling.

N. G. de Rachat. U.S.P. 1,979,532, 6.11.32. Cracked products while still hot are passed to a coking zone and impinged against a rapidly rotating surface in contact with hot gases, whereby the unvaporised oil is reduced to coke.

L. C. Huff. U.S.P. 1,980,204, 13.11.34. Cracked products are dephlegmated to form a primary and a lighter secondary reflux. Part of the former is used to cool the products from the reactor, and part passed to the heating zone. The secondary reflux is cracked at a higher temperature, and then passed into the reactor.

W. H. McAdams, and H. C. Weber. U.S.P. 1,980,215, 13.11.34. Cracked vapours from a cracking plant are divided into two portions. One is fractionated and the overhead passed to a stabiliser, at the bottom of which the gasoline is allowed to collect. The other portion is introduced without cooling in direct heat exchange with the gasoline condensate in the lower part of the stabilising zone.

A. M. Wood. U.S.P. 1,980,462, 13.11.34. Oil is partly vaporised and the vapours are passed through a cracking zone counter-current to the stream of oil in indirect heat exchange.

J. B. Webre. U.S.P. 1,980,839, 13.11.34. Oil is heated to cracking temperature and passed through a plurality of series-connected still chambers. The reflux condensate from the process is reheated and passed through an injector pump adapted to withdraw residual oil from the last still, the mixture being recycled to the first still of the series.

J. B. Heid. U.S.P. 1,981,144, 20.11.34. Oil vapours are passed in indirect heat exchange with a gaseous heating medium and simultaneously heated by radiation. The vapours are then combined with the heating medium, and a portion is burned in order to supply additional heat for cracking.

R. Pyzel. U.S.P. 1,981,150, 20.11.34. Combustion gas devoid of free oxygen and at 1600–2500° F. is mixed with sufficient cool uncondensable hydrocarbon gas to reduce

its temperature to 1300–1800° F. The mixture is commingled with oil vapours in order to convert the latter into gasoline hydrocarbons.

W. F. Sims and V. U. Cloer. U.S.P. 1,981,572, 20.11.34. Oil is vaporised in a thin-film vaporiser operated under reduced pressure. The vapours while still under sub-atmospheric pressure are cracked, fractionated, and condensed.

W. L. Gomory. U.S.P. 1,981,727, 20.11.34. Oil is cracked and passed to a vaporising zone under reduced pressure. The residue is cracked in a second coil in contact with hydrogen, and the cracked products are discharged into the vaporising zone.

E. B. Peck and C. E. Kleiber. U.S.P. 1,981,826, 20.11.34. Oil is heated under pressure to a temperature of not more than 850° F., and sufficient gaseous oxidising agent is injected into the heated oil to double the rate of rise in temperature to 950–1100° F. by partial combustion.

P. C. Keith. U.S.P. 1,981,842, 20.11.34. The viscosity of the charging stock is reduced in order to increase the percentage of components suitable for cracking.

E. W. Beardsley. U.S.P. 1,981,852, 27.11.34. A combined reaction chamber and scrubber.

E. C. Herthel. U.S.P. 1,981,914, 27.11.34. A high-boiling distillate is heated under pressure in the primary and secondary stages of a heating zone. A cracked residue is mixed with the oil as it passes from the first to the second stage, the latter being at a lower temperature and pressure than that of the primary stage.

A. R. Workman. U.S.P. 1,982,091, 27.11.34. A cracking process in which the recycle stock or any intermediate distillate is stripped of its content of light constituents under reduced pressure.

J. G. Alther. U.S.P. 1,982,462, 27.11.34. Unvaporised cracked oil is removed from the reaction zone to a second enlarged zone where further separation of vapours is effected. The vapours are dephlegmated and the reflux condensate is returned to the heating zone.

G. Egloff. U.S.P. 1,982,469, 27.11.34. Cracked residue with reflux condensate is cracked to yield gas, vapours, and coke.

J. Y. Johnson. E.P. 420,235, 28.11.34. Oils poor in hydrogen are mixed with a crude oil rich in hydrogen and with a finely-divided catalyst. The mixture is heated at 450–600° C.

E. Livraghi. E.P. 420,370, 26.11.34. Plant and process for continuous heat treatment of liquid hydrocarbons, and asphaltic materials or mixtures of these with methyl or ethyl alcohols, for the production of anti-detonating fuel. W. H. T.

H. Plauson. D.R.P. 600,002, 27.2.31. Alcohols are dehydrated and hydrocarbons cracked by the aid of catalysts, which are produced by fusing alkali—or earth alkali—or heavy metal salts of fluosilicic acid with an excess of phosphoric acid and/or boric acid. L. S.

Bataafsche Petroleum Mij. D.R.P. 605,901, 10.9.27. Oil is passed in turbulent flow at as high a temperature as possible through tubes, and then exposed with further turbulent flow to a lower temperature, after which it is transferred into a non-heated insulated cracking chamber, where cracking is completed. L. S.

Gewerkschaft Mathias Stinnes. D.R.P. 606,200, 12.9.30. High-boiling aromatic hydrocarbons are converted into low-boiling hydrocarbons by oxidation of coal-tar oils boiling above 200° C. and decarboxylation at elevated temperatures and pressures by the aid of a slime of $CaCO_3$ or $Ca(OH)_2$ with addition of alkali. L. S.

C. Still. D.R.P. 606,985, 7.8.32. A constant oil stream is introduced into a distilling or cracking plant by a pump. If the supply from a supply tank is diminished by accident, the necessary oil is added by an overflow from a second tank by means of a second pump. L. S.

217. Patents on Hydrogenation. M. Pier and F. Ringer. U.S.P. 1,979,841, 6.11.34. Non-knocking motor fuels are produced from aldehydes and alcohols having side-chains and with more than three carbon atoms to the molecule by catalytic reduction with hydrogen under increased pressure at 350° to 500° C.

L. Szesyich. U.S.P. 1,982,556, 27.11.34. Ash and asphaltic material are removed from stocks intended for hydrogenation by a pre-treatment. This treatment consists of passing the oil or tar at 100–250 atm. pressure and at 375–475° C. in the presence of hydrogen through separation zones filled with inert non-catalytic filling material having smooth surfaces. W. H. T.

218. Patents on Crude Oil. C. H. M. Roberts. U.S.P. 1,979,347, 6.11.34. A demulsifying agent for breaking water-in-oil emulsions consisting of a modified hydrocarbon of the type $DZ'.XO.T$. in which Z' is a petroleum hydrocarbon residue, D is a hydrogen atom or a derivative radical, XO is an oxygen-containing radical selected from hydroxyl radicals, aldehyde radicals, or ketone radicals attached to an inert carbon atom of the hydrocarbon residue, and T is a halogen.

C. Tyler. U.S.P. 1,980,118, 6.11.34. Emulsions are resolved by the addition of a mixture of alcohols (b.-p. 100–210° C.) obtained by the catalytic hydrogenation of carbon monoxide under high pressure. W. H. T.

219. Patents on Gas. W. W. Odell. E.P. 418,779, 31.10.34. Treatment of combustible gas containing unstable olefine hydrocarbons. The gas is preheated (300–800° F.) and mixed with the hot products of combustion of a hydrocarbon, the mixture being then brought into contact with a bed of solid refractory material. Olefines are thus converted into vapours of more stable type.

R. E. Burk and H. P. Lankelma. U.S.P. 1,980,380, 13.11.34. Apparatus for the conversion of waste refinery gases into motor fuel. The gas is preheated to 900–1000° F. and passed to a reaction zone, which is lined with alundum, sillimanite, silica, silicates, porcelain, etc.

P. J. Wiezevich and J. M. Whiteley. U.S.P. 1,981,819, 20.11.34. A process for polymerising gases and light liquids containing high percentages of olefines. The gases and liquids are preheated, and then mixed with a gaseous oxidising agent insufficient to react with the total olefines. The mixture is maintained at 310° C. and 870 lb./sq. in. pressure for 5–10 hrs., after which the product is withdrawn and cooled. W. H. T.

220. Patents on Motor Spirit. Yorkshire Tar Distillers. E.P. 419,312, 9.11.34. Removal of carbon bisulphide and free sulphur from motor spirit (benzole). The material is treated with a reagent containing a polysulphide of ammonia, a disulphide, ammonia, and ammonium monosulphide.

Clayton Son & Co. and W. Sowden. E.P. 419,545, 14.11.34. A method of regenerating the wash oil used in the recovery of benzole and similar hydrocarbons from coal gas. A predetermined proportion of the hot de-benzolised creosote oil is removed from circulation at a point near the outlet of the separating still, steam distilled, and returned to the system.

Standard Oil Dev. Co. E.P. 419,690, 16.11.34. In order to prevent or minimise gum formation in engines, a "gum flux" is added to the fuel to the extent of 0·1–2·0%. The flux is a normally liquid hydrocarbon (naphthenic) having a kauri butanol value above 15, a low vapour pressure, a viscosity between 70 and 450 secs. Say. and an A.P.I. gravity between 18 and 28.

H. H. Cannon. U.S.P. 1,979,448, 6.11.34. A sweetening process in which sour distillates are treated with a mixture of calcium hydroxide and lead monoxide.

J. C. Morrell and G. Egloff. U.S.P. 1,979,565, 6.11.34. Vapour-phase treatment of cracked distillate at 250–600° F. with sulphur dioxide and free oxygen in the presence of an oxide of a heavy metal and steam.

E. A. Dickinson. U.S.P. 1,979,734, 6.11.34. Apparatus for the vapour-phase treatment of cracked distillates with solid adsorbents.

H. Schöneborn. U.S.P. 1,980,009, 6.11.34. Recovery of wash-oil used for benzole extraction in which the oil is distilled and washed with water in order to remove soluble corrosive salts.

R. F. Davis. U.S.P. 1,980,189, 13.11.34. Removal of heterocyclic sulphur compounds from oils by treatment with a halogen in the presence of a catalyst. The mixture, together with piperidine, is finally heated to a relatively elevated temperature.

W. A. Schulze and F. E. Frey. U.S.P. 1,980,555, 13.11.34. A method for stabilising oil, previously treated with a copper reagent, against catalytic deterioration. The oil is treated with a sulphide of an alkali or alkaline earth at atmospheric temperature.

U. B. Bray, R. C. Pollock and D. R. Merrill. U.S.P. 1,981,305, 20.11.34. Vapour-phase refining of cracked spirit by means of an adsorbent followed by treatment in the presence of a catalyst (metallic sulphide). W. H. T.

Oranienburger chem. Fabrik. D.R.P. 605,802, 17.11.29. Improvements in the process dealt with in D.R.P. 601,802. The first treatment is with chlorosulphonic acid,

followed by fuming or concentrated sulphuric acid. Sludge is removed, and the treated material washed and dried. L. S.

J. W. Orelup. E.P. 420,371, 26.11.34. Petroleum products are stabilised against the formation of gum and colour by the addition of binaphthylene oxide or dioxide or perylene. W. H. T.

221. Patents on Kerosine. J. Buckland. E.P. 419,891, 21.11.34. An oil lamp is described having a large reservoir, a gallery, burner, and chimney, together with an additional sheet-metal stove chimney surrounding the lamp chimney. The stove chimney is supported on the reservoir, and is provided with holes at both ends, whilst a canopy-like baffle plate is attached at the top. W. H. T.

222. Patents on Lubricating Oil. Bataafsche Petr. Maatschappij. E.P. 419,820, 12.11.34. Process for reducing the pour-point of oils by adding small quantities of organic compounds, *e.g.* distearyl naphthalene, dimyricyl ether of 1:5-dioxynaphthalene, cerotic acid, ester of cholesterin, etc.

R. E. Manley. U.S.P. 1,980,071, 6.11.34. Separation of wax from oils by mixing the oil with a solvent containing acetone and benzole and chilling the mixture to 0° F. to precipitate the wax. Pressure is applied to remove the solvent and liquid hydrocarbons. More solvent is added and cooled to 0° F., and a cool gas is forced finally through the washed filter cake to remove the solvent liquid.

A. B. Brown and A. W. Neeley. U.S.P. 1,980,377, 13.11.34. Process described for the production of high-viscosity lubricating oils for aeroplane engines. The oils are treated successively with 93–100% sulphuric acid at a temperature above 160° F. and then with fuming sulphuric acid. The sludge is separated after each successive treatment, and finally the oil is treated with anhydrous aluminium chloride to remove sulphuric acid derivatives.

V. Voorhees and J. A. A. Anderson. U.S.P. 1,980,649, 13.11.34. Separation of wax from mixed base lubricating oils using liquefied propane.

H. Svanoe. U.S.P. 1,981,758, 20.11.34. Dewaxing of oils by diluting the oil with a mixture of oxygenated organic compounds, *e.g.* alcohols boiling between 290° and 410° F., which have been obtained by the catalytic hydrogenation of a carbon oxide under pressure. The mixture is filtered to separate the wax, which is removed. A given quantity of methanol is added to the mixture to separate the oil from the dewaxing agent and methanol.

W. Grote and P. Obergfell. U.S.P. 1,982,513, 27.11.34. A method is described for the recovery of the solvent contained in the extract-solution in the treatment of kerosines and lubricating oils with sulphur dioxide. The extract-solution is passed through successive evaporation zones operated at decreasing orders of pressure, and including a high-pressure zone followed by a condenser pressure zone. The liquid level in the latter zone is kept at a predetermined point by automatically controlling the outflow of the raffinate solution. W. S. E. C.

223. Patents on Asphalt. O. R. Douthett. U.S.P. 1,979,676–7, 6.11.34. A method for lowering the susceptibility to temperature change of bitumen in which the latter is contacted with a halogen in admixture with oxygen at 450–600° F. W. H. T.

Class 700. Utilisation.

224. Exhaust Gas Analysis. W. H. Paul and G. W. Gleeson. *Nat. Petr. News*, 26.9.34, **26** (39), 21; 3.10.34, **26** (40), 42; 10.10.34, **26** (41), 35.—Air/fuel ratios are essential to a comprehensive study of the dependent variables involved in the internal combustion engine, but they are almost impossible to determine accurately. However, it is demonstrated that exhaust gas analyses form a simple and reliable means of establishing these ratios. The article discusses the methods available, and correlates the various determinations made. It is shown that with the help of the graphs published the determination of a single constituent, say CO_2, leads to the complete knowledge of the composition of the exhaust, and hence the air/fuel ratio. Correlations are also made of CO_2 content with thermal and power efficiencies, speed and fuel consumption, thereby demonstrating that engine adjustment can become a matter of considerable accuracy, instead of an operation which is largely empirical in nature. H. G.

225. CO/H_2 Ratio in the Products of Combustion from Automotive Engines. G. W. Gleeson and W. H. Paul. *Nat. Petr. News*, 12.9.34, **26** (37), 32.—As a result of the correlation of the results of 645 exhaust gas analyses, figures have been obtained over a wide range of values, and the authors have reached the following conclusions: 1. That previous discussions of CO/H_2 ratios have been essentially correct for the limited range of values with which they have dealt; 2. It is possible to obtain a lineal relationship between the reciprocals of CO and H_2 concentrations when the relationships between the straight functions are definitely not linear; 3. An approximation of the water gas equilibrium constant $K_{WG} = CO \times H_2O/CO_2 \times H_2$ indicates that for hydrogen concentrations above 3%, such a constant does not exist if the "freezing" temperature of 1500° C. is correct. H. G.

226. Forced Induction Possibilities for Automotive Vehicles. L. Schwitzer. *J.S.A.E.*, 1934, **35**, 454–462.—The author considers that the only satisfactory method of improving the performance of the modern motor car lies in the adoption of forced induction, in addition to improvements in design such as stream-lining, etc. Of the three types generally used, viz. the vane, Roots, and centrifugal, the latter presents the fewest problems, as it is the most silent, the least expensive, and the easiest to manufacture. Curves are given showing the effect of a standard centrifugal type of supercharger to a standard American car. The economy is improved throughout the entire speed range at full power, whilst the peak H.P. is 90 at 3200 r.p.m. unsupercharged, as against 132 H.P. at 4000 r.p.m. with supercharger. With this type of blower tests have shown that the overall friction horse-power at 3000 r.p.m. is increased by only approx. 50% of the H.P. input to the blower, as much of the power used to drive the blower offsets the pumping losses of the engine. As the power absorbed by the blower falls sharply as the throttle is closed, the small ratio of losses is substantially maintained. The mechanical agitation of the mixture in the rotor chamber is also productive of even firing and generally smoother running. This article has many illustrations of various types of supercharger, showing the details of the assemblies. The author believes that in a comparatively short time mechanical induction will become general practice. C. H. S.

227. Synthetic Alcohols from Mixtures of Gases. J. Cristesco. *Fuel*, 1935, **14**, 23. (Paper presented at 3rd Congress du Chauffage Industriel, Paris, Oct. 1933.)—The process described in this paper is covered by Roumanian Patent 21,598, 17.3.33. Gas mixtures at atmospheric pressure are bubbled through boiling water containing submerged catalysts. The liquid obtained by condensing the vapours is fractionally distilled to separate the alcohols, and the uncondensed gases are passed through washers in order to recover aldehydes. A diagram and description of the experimental plant are given. Using a mixture of one part of air with three parts of methane and a catalyst of metallic oxides (*e.g.* lead peroxide with granular copper oxide as supplementary catalyst), methyl alcohol, formaldehyde, and methylal are produced. The condensation effect of the aldehydes tends to give rise to complex mixtures in which the higher alcohols and their isomers predominate. The formation of methanol can be explained by $CH_4 + H_2O = CO + 3H_2 = CH_3OH + H_2$. For the synthesis of ethyl alcohol from hydrogen and carbon dioxide, the catalyst consists of wood charcoal treated with caustic soda solution, together with a supplementary catalytic mixture of cobalt and zinc oxides. It is claimed that the procedure permits the commercial manufacture of alcohols from methane, producer gas, lighting gas, etc. W. H. T.

228. Miscibility of Gasoline and Technical Alcohol for Aero-Engine Fuel. T. Araki and M. Nakabayashi. *J.S.C.I., Japan*, 1934, **37**, 685B.—The amount of water which can be added to mixtures of gasoline and absolute alcohol without causing turbidity is proportional to the concentration of alcohol in the mixtures, and increases as the temperature rises. The relation between critical solution temperature and water content may be expressed by the equation $\log S = a + b/T$, where S is the water content (% by vol.) of the mixture, T is the C.S.T., and a and b are constants obtained from experimental data. W. H. T.

229. Liquefied Gases as Fuel for Internal-combustion Engines. K. Hopfer. *Öl und Kohle*, 1934, **2**, 557–559.—The experiments described show that 1 kgm. of butane or propane when used in an engine is equivalent to 1·7–1·8 litres of benzine, corresponding to a decrease in thermal efficiency of 10–15%. The output of the engine in H.P. is just as high as that obtained with benzine. W. S. E. C.

230. Improved Motor Oils. M. Otto, F. L. Miller, A. J. Blackwood, and G. B. H. Davis. *Refiner*, 1934, **13**, 411–422.—Present-day driving conditions have emphasised the importance of supplying the motorist with a crank-case oil outstanding in the following characteristics: (1) Low consumption; (2) low carbon and sludge-forming tendency; (3) ability to give safe lubrication; (4) maintenance of piston seal; (5) free flowing in cold weather. Analysis of operating conditions indicates that for the satisfaction of these requirements, motor oils of viscosity index 120 and upwards are required. Intensive efforts have been made to improve the paraffinicity of mineral oils by methods which include hydrogenation, solvent extraction, aluminium chloride treatment, and treatment with fuming sulphuric acid. Limitation attaches to the improvement attainable in practice using these methods, largely because the concentration of paraffin wax builds up with the increasing severity of treatment necessary to reach the higher viscosity indices, and when dewaxed the oil is rarely over 115 V.I.

The work of Sullivan and co-workers demonstrated that synthetic oils of high V.I. may be prepared by the condensation of cracked paraffin wax with aluminium chloride, that the V.I. improved with the increasing length of the unsaturated paraffin used in the polymerisation, associated however with increasing pour-point, indicating the desirability of the production of a type of *iso*paraffinic material of relatively high molecular weight, but of low pour.

The production of such compounds has been achieved by the polymerisation of the light ends of refinery gasoline to materials which are termed "Exanols," ranging from light fluid oils to highly viscous polymers which scarcely flow. These materials are saturated in character, and when dissolved in mineral oils increase the viscosity index even when used in low concentrations.

Extensive performance tests have been conducted on blended oils of this type, and have demonstrated their high quality in all five of the characteristics previously indicated. B. C. A.

231. Automotive Lubrication and Lubricants. H. C. Mougey. *Nat. Petr. News*, 26.12.34, **26** (52), 23.—Owing to the diversified character of the products of different grease-makers and the various and exacting demands of the various parts of an automobile chassis, the recommendation of the appropriate grease is very difficult. The author stresses the need for the makers drawing up classifications in collaboration with automobile makers. The classification should be on a quantitative basis, and merely descriptive terms eliminated. In this way automobile makers would be able to make positive and definite recommendations, and in the design of new parts could work in the knowledge of the exact capabilities of some particular lubricant. H. G.

232. E.P. Lubricants. H. C. Mougey. *Nat. Petr. News*, 14.11.34, **26** (46), 39; *Oil & Gas J.*, 15.11.34, **33** (26), 123.—The author states that extreme pressure lubrication is a function both of the lubricant and the surface of the bearing. He also states that the difference between the conditions prevailing during the use of E.P. lubricants and straight mineral oils lies in the difference in the surface of the bearing. This difference is produced by reaction with the sulphur, chlorine, or other E.P. ingredient, which reaction is essential. Hence, oils containing free sulphur, for instance, are more efficient than those in which the sulphur is in a state of chemical combination. Similarly, oils containing lead soaps, although they do possess E.P. characteristics, take a long time to build up the protective film. He emphasises the fact that the results given by E.P. testing machines cannot be translated directly in terms of service conditions, and that rubbing speeds are probably more important than bearing pressures. These two functions should always be considered together in determining the E.P. characteristic of an oil. H. G.

233. Quality Oils Needed for Best Lubrication of Solid-Injection Diesels. W. G. G. Godron. *Oil & Gas J.*, 15.11.34, **33** (26), 76.—In analysing the operating conditions and lubrication requirements of Diesel engines the parts may be classified in two groups: (*a*) power cylinders; (*b*) bearings. The conditions of operation and influence of various factors on oil requirements are discussed. Correct lubrication of Diesel power cylinders implies the furnishing of a lubricating oil film that will prevent metal-to-metal contact, and assure perfect piston seal with minimum carbon formation. The lubricating oil must, therefore, have characteristics that will give its film sufficient

strength at the high temperature and pressure to which it is exposed, a fluidity that will permit ready distribution, and ability to resist the formation of carbon deposits.

Since all high-speed automotive Diesels and many stationary engines are designed to use the same oil for cylinder and bearing lubrication, the choice of oil becomes even more important in such cases. Oil for circulation systems should thus possess the characteristics specified for power cylinder oils, and in addition: (1) High chemical stability, or resistance to the destructive influence of continued circulation with solid and liquid impurities (*e.g.* deposits, fuel, and water) and of agitation in the presence of air; (2) Ability to separate readily from solid impurities and water, in order to avoid formation of sludge and emulsions and clogging of oil pipes, etc.; (3) Correct body and fluidity to assume maintenance of effective oil films under the most severe operating conditions. R. A. E.

234. Industrial Lubrication and Lubricants. O. L. Maag. *Nat. Petr. News*, 24.10.34, **26** (43), 27.—The author reviews the requirements of various types of bearings and the applications of the several varieties of lubricants. Particular reference is made to the lubrication of roller bearings in their different applications. The relative merits of soda base, lime base, and aluminium and lead soap greases are discussed, together with the applications of E.P. lubricants incorporating sulphurised and chlorinated fatty oils. It is stated that the film strength of an E.P. lubricant increases with increase of sulphur content up to 3% S, but that the wear-producing properties of the oil increase collaterally. In contrast, with a chlorinated oil wear decreases with increase in the chlorine content. H. G.

235. Lubrication of Machines Used in the Cement Industry. E. H. Kadmer. *Petr. Z.*, 5.12.34, **30** (49); *Motorenbetrieb*, **7** (12), 2–6.—Types of lubricants necessary for the lubrication of various types of crushing and grinding machines and rotary furnaces are indicated. The lubricants consist chiefly of mineral oils, fatty oils, and graphite. W. S. E. C.

236. Engine Lubrication with Different Bearing Metals. C. M. Larson. *J.S.A.E.*, 1934, **35**, 444–453.—With the convential bearing metal the load that can be carried by straight mineral oils when compared at 100 seconds (Saybolt Universal) viscosity increases with the S.A.E. number of the oil. Addition of fixed oils to the mineral oil improves the viscosity index of the oil and enables higher loads to be carried at high temperatures. For example, an S.A.E. 10 W. oil compounded with a fixed oil more nearly approaches an S.A.E. 30 oil. For both good and bad viscosity index oils higher loads can be carried when the bearing is of Babbitt metal than when it is composed of copper–lead alloys. It is advantageous to use good viscosity index oils with copper–lead bearing metals, particularly in the case of S.A.E. 10 W. oil. Friction experiments show that the coefficient of friction with copper–lead bearings is lower than with Babbitt metal bearings, when either straight mineral or compounded oils are used. Some compounding agents raise the coefficient of friction above that of the straight mineral oil. Bearing metals of copper–lead bronze have most effect on deterioration of oil at high temperatures, particularly on oils of bad viscosity index.

When bearings are held for a long time at a high temperature in oils previously artificially sludged, there is no increase in coefficient of friction.

Running-in compounds must be used with caution with lead–bronze and copper–lead bearings. CCl_4 in a concentration of 1%, while being safe for steel on steel, is dangerous above 0·04% for copper–lead bearings. Similarly, sulphur chloride must not exceed a proportion of 0·005% to be effective.

The article is amply illustrated with photographs, sketches, and graphs. J. L. T.

237. Fundamentals in the Selection of Cutting Oils. W. D. Huffman. *J.S.A.E.*, 1934, **35**, 463–466.—In this article cutting oils are classified according to composition and use. The significance of their properties is discussed, and a strong plea entered for closer co-operation between workshop and laboratory. J. L. T.

238. Paraffin and its Uses. M. Friedwald. *Rev. Petr.*, 8.12.34 (608), 1501–1503.—The author shortly discusses the manufacture of paraffin wax and the tests carried out on the refined product. The following uses are briefly described. In the manufacture of (i) candles, tapers and polishes, (ii) pharmaceutical preparations such as laxatives, unguents for burns, dressings, therapeutic materials, antiseptic ointments, and dental

materials, (iii) cosmetics such as creams, pomades, and dentrifices. As a waterproofing agent it is used in the paper, leather, and textile industries, and is also used in the preservation of wood by impregnation and in the preservation of fruits by coating. Its insulating properties are utilised in the electrical trade. Minor uses of paraffin wax are in the preparation of cleansing mixtures, in the production of carbon paper, in cartridges, as anti-rust material, and to prevent the growth of moss on marble. A bibliography of 33 references is given. G. R. N.

239. Utilisation of Petroleum Products as Horticultural Spray Materials. H. Martin. *J.I.P.T.*, 1934, **20**, 1070–1089.—A paper with discussion on the results of laboratory and field trials of oil emulsions used as ovicides and insecticides. G. R. N.

240. Some Malarial Problems in Trinidad and their Control. E. de Verteuil. *J.I.P.T.*, 1934, **20**, 1090–1099.—A paper read at the Trinidad branch on the history, survey, and control of malaria with special reference to Trinidad. G. R. N.

BOOK REVIEWS AND BOOKS RECEIVED.

Reviews.

HANDBOOK OF CHEMISTRY. N. A. Lange, Ph.D. Pp. 1545. 1934. Handbook Publishers Inc., Sandusky, Ohio. $6·00.

This volume has succeeded in retaining all the good qualities while rejecting nearly all the bad features of the various chemical handbooks with which we are familiar. Of equal importance, in a book of this class, are the contents and the arrangement; equal care has been expended on each, and the combination has resulted in a most admirable work of reference.

Professor Lange acknowledges the material assistance of many eminent chemists and chemical organisations in the U.S., and the table of contents bears testimony to the scope and value of their co-operation. In addition to the usual classes of tables found in chemical and physical handbooks, one finds up-to-date sections on such less familiar subjects as industrial water purification, refrigerants and cold storage, pipe-line transmission of fluids, physiological response to gases, synthetic resins and plastics, vitamines, modern fuels, and radioactive materials and radioactivity.

The value of the data is much enhanced by the fact that in many cases the source or authority is quoted. It is true that some of the tables are expressed in American units which are unfamiliar in this country, but these constitute a quite insignificant proportion of the total.

A purely mathematical section of 250 pages will also have value for a certain section of readers.

Special commendation must be given to the production of the book. The size and clearness of the printing, a weak spot in many such handbooks, are beyond criticism, whilst the arrangement of the tabular matter bears evidence of the most careful consideration.

Although the handbook has been compiled primarily for chemists, those engaged in all branches of physics will find much of value. This reference work can unhesitatingly be recommended to chemists and physicists as the largest and best book of its kind yet published.

F. B. THOLE.

Books Received.

AMERICAN SOCIETY FOR TESTING MATERIALS: INDEX TO A.S.T.M. STANDARDS AND TENTATIVE STANDARDS. 138 pp. 8vo. 1935, A.S.T.M., 250 S. Broad St., Philadelphia. Gratis.

This index to the A.S.T.M. standards, which number about 730, is intended to be of service to engineers, purchasing agents, etc., in determining whether a specification or test for a particular material has been issued.

British Standards Institution:

B.S.S. 348—1935. Compressed Rock Asphalt.
B.S.S. 571—1934. Distillation Flasks.—This covers flasks having distillation capacities of from 30 to 3000 ml.
B.S.S. 573—1934. Dibutyl Phthalate.
B.S.S. 574—1934. Diethyl Phthalate.
B.S.S. 575—1934. Carbon Tetrachloride.
B.S.S. 577—1934. Hexachlorethane (Hexachloroethane).
B.S.S. 578—1934. Technical Acetic Acid.
B.S.S. 579—1934. Technical Ether.
B.S.S. 580—1934. Trichlorethylene (Trichloroethylene) (Technical and stabilised).
B.S.S. 594—1935. Rolled Asphalt. Fluxed Lake Asphalt and Asphaltic Bitumen. Hot Process.
B.S.S. 595—1935. Rolled Asphalt. Fluxed Natural Asphalt and Asphaltic Bitumen. Hot Process.
B.S.S. 596—1935. Mastic Asphalt Surfacing. Fluxed Lake Asphalt and Asphaltic Bitumen. Hot Process.
B.S.S. 597—1935. Mastic Asphalt Surfacing. Fluxed Natural Asphalt and Asphaltic Bitumen. Hot Process.

COLOMBIA. COMPILACION DE LOS ESTUDIOS GEOLOGICOS OFICIALES EN COLOMBIA 1917 A 1933. Tomo II. 425 pp. 8vo. 1934, Imprenta Nacional, Bogota.

Contains a number of papers on the geology of various districts in Colombia.

HOKKAIDO IMPERIAL UNIVERSITY. JOURNAL OF THE FACULTY OF SCIENCE. SERIES IV, GEOLOGY AND MINERALOGY, VOL. II, NO. 4.

IRAQ PETROLEUM COMPANY. THE STORY OF THE IRAQ–MEDITERRANEAN PIPE-LINE. 125 pp. 4to. 1934.

A detailed account of the design and construction of the pipe-lines from Kirkuk to Haifa and to Tripoli, well illustrated with photographs of the work in progress and the various operations connected therewith. Photographs are included of the men who were in charge of the work, to whom the book is a tribute.

JUNIOR INSTITUTION OF ENGINEERS. JOURNAL AND RECORD OF TRANSACTIONS, VOL. XLIV, 1933–34.

This contains the papers, and discussions thereon, presented to the Institution during the Session 1933 to 1934. Included in these papers are: "Air Lift Pumps," by A. C. Judd, and "Characteristics of Fuels used in the Internal Combustion Engines," by J. S. Clarke.

LUTS, K. DER ESTLÄNDISCHE BRENNSCHIEFER-KUKERSIT, SEINE CHEMIE, TECHNOLOGIE UND ANALYSE. 356 pp. 8vo. 1934, Verlag der Staatlichen Brennschiefer-Industrie Estlands, Tallin. 15 Kr.

Deals with the chemical composition of the Estonian oil-shale, Kukersit, and the oil obtained therefrom. The methods of retorting the shale and refining the oil are discussed and analytical details are given.

ÖSTERREICHISCHES PETROLEUM-INSTITUT. ALKOHOL-GEMISCHKRAFTSTOFFE. 30 pp. 8vo. 1934, Verlag für Fachliteratur G.m.b.H., Vienna. 2 sch.

A brochure of the Austrian Petroleum Institute, dealing with the use of alcohol fuels for internal-combustion engines. A bibliography of 139 references is appended.

U.S. Bureau of Mines:

R.I. 3252. TABULATED ANALYSES OF TEXAS CRUDE OILS. By Gustav Wade.

This document brings together in tabular form all the analyses of Texas crude oils that have been examined and published by the Bureau, together with a number of unpublished results. The tables are arranged in six geographical sub-divisions of the State and according to the geological age of the producing formations.

U.S. Bureau of Standards:

Research Paper RP 718. STANDARDIZATION OF LOVIBOND RED GLASSES IN COMBINATION WITH LOVIBOND 35 YELLOW. By Kasson S. Gibson and Geraldine Walker Haupt. 19 pp. 8vo. 1934, Supt. of Documents, Washington, D.C. 5 c.

Describes the fundamental standardization of the Bureau's Lovibond red glasses, the purpose being to derive new numerals for the Bureau glasses. The standardization is based upon spectrophotometric analyses of the glasses when in combination with Lovibond 35 Yellow.

Research Paper RP 721. HEAT OF COMBUSTION OF STANDARD SAMPLE BENZOIC ACID. By Ralph S. Jessup and Carleton B. Green. 27 pp. 8vo. 1934, Supt. of Documents, Washington, D.C. 5 c.

The bomb calorimeter used and its calibration are described. The value obtained for the heat of combustion of standard sample benzoic acid is 26,419 international joules per gram mass when burned at 25° C. in oxygen under an initial pressure of 30 atm. abs.

ABSTRACTS.

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Class 100. Geographic Occurrence.

241. World Statistics for Bitumen. W. Schmidt. *Bitumen*, 1934, **10**, 233–240.—After falling steadily from 1929 to 1932, production throughout the world recovered a little in 1933. The U.S.A. still retains its position as the largest producer of bitumen, but its output has declined steadily from 78·6% of the world's total of 5,400,000 tonnes in 1929, to 65·6% of 4,600,000 tonnes in 1933. Great Britain is second on the list, with 11·8% of the world's and almost half of Europe's total production in 1933. Germany comes third, with 7·1% of the world's total in 1933, having risen steadily from 2·8% in 1929. The figures are further analysed and tabulated with respect to imports, exports, and consumption, so that it is possible to see at a glance the origin and movements of bitumen in practically every country in the world.

For natural asphalt, the figures are not so complete, the statistics for 1933 ending at the month of September, and even then they exclude production amounts which so far are certain only for 1932. That year showed a world production of 665,000 tonnes, a fall of nearly one-third of the 1931 figure. The U.S.A. again headed the list in 1932, with 284,890 tonnes, followed by Italy with 128,300 tonnes and Trinidad with 109,190 tonnes. J. L. T.

242. German Oil Production, 1933. W. G. Simon. *Kali*, 1935, **29** (2), 15–20.—The production of crude petroleum in Germany during 1933 was as follows: Hänigsen-Nienhagen, 145,980 tonnes; Wietye-Steinförde, 53,805 tonnes; Oberg-Edisse-Berkhöpen, 33,906 tonnes; Volkenroda, 5,900 tonnes; total 239,591 tonnes. The total production is 6% of the total demand. L. S.

243. Petroleum Markets in Tripoli. A. M. Morgantini. *Mon. Petr. Roum.*, 1934, **24**, 1583–1592.—Statistics are given relating to population, number of automobiles, railways, etc. The possible occurrence of petroleum in Tripoli is discussed, and the laws concerning mining concessions are explained. Customs and import duties are discussed at length, and tables are given showing imports of all petroleum products, coal, and coke, for the years 1921–1933. A. O.

Class 200. Geology and Origin.

244. Heavy Mineral Studies on Correlation of Sands at Kettleman Hills, California. M. N. Bramlette. *Bull. Amer. Assoc. Petr. Geol.*, 1934, **18**, 1559–1576.—In view of the poor faunas obtained and of lateral variations of lithology, a study of the petrography of the sands at Kettleman Hills was made in the hope that that would provide additional data to aid in correlation. It was found possible by this means to distinguish several zones which are given below in ascending order.

Basal Temblor. 100 ft. sandstone overlying Kreyenhagen shale, and distinguished from zone above by nondescript character of the mineral assemblage.

Andesitic sand zone. Characterised by abundant andesine and andesitic pyroclastic materials, is well defined, and forms major part of Temblor (Mid. Miocene).

Orthoclase-Anhydrite zone. A thin, distinctive zone about 100 ft. above the andesitic sand zone.

600-ft. *Shale.* Not a mineral zone, but is an important key bed in the wells, and occurs 600 ft. below the top of the producing sands in the North Dome.

Big Blue serpentine zone. About 150 ft. thick, and occurs 100 ft. below top of producing sands in North Dome wells. Distinguished by abundance of serpentine grains and of green garnet. Above this zone in the North Dome the remaining 100 ft. of producing sands have no distinguishing feature; they become more shaly in the south part of that dome and in the Middle Dome. These beds are mainly shale lithologically similar to the overlying McLure shale.

Bentonite key bed. One or more thin bentonite beds in the basal McLure shale, the lowest of which, 50–80 ft. above the top of the sands in the North Dome, is used as a key bed.

McLure shale. About 900 ft. in wells on North Dome, and increasing southward. A hard siliceous brown shale with diatom casts and fish scales. Upper limit indefinite.

Caving shale. Blue sandy shale with thin sands. The sands have a bentonite matrix, and show abundant andesine, biotite, and secondary dolomite.

Andesitic sands of Jacalitos formation. Contain an abundance of fresh-zoned andesine and ferromagnesian minerals.

Andesitic sands of Etchegoin formation. Distinguished from those of the Jacalitos by abundant hypersthene.

The zones as determined by the mineral assemblages appear to be in agreement with what palæontological evidence is available, and indicate that the upper 600 ft. of the producing sands have little development in the outcrops. The sands in the outcrops are correlated with strata at depths of 1000 ft. in the producing horizon.

Particulars of individual minerals are given. S. E. C.

245. Gas and Oil Possibilities of Oriskany Sandstone, North-west Pennsylvania. C. R. Fettke. *Oil & Gas J.*, 31.1.35, **33** (37), 113–114.—The Oriskany Sst. is of Lower Devonian age, and outcrops in thin lenses along a general E.–W. line passing through Buffalo and Southern Ontario. Further south it again outcrops, and here its thickness is between 60 and 100 ft., although the outcrop is not continuous. It has been tested by a few wells, mainly in Allegheny Co., and a show of gas has been obtained, but up to the present no oil has been proved in commercial quantities. Salt water has been found in some of the wells, but in others the sandstone is found to be metamorphosed. Most of the well-cuttings available for examination show the presence of calcium carbonate and secondary silica which has reduced the porosity of the rock. The isocarb lines are drawn on a map which accompanies the paper, and it is noted that metamorphism increases from N.W. to S.E.

The structure of the general Appalachian area is reviewed, and the possibilities of such structures as terraces, monoclinal noses, gentle domes, etc., occurring in the Oriskany Sst., are considered; it is thought that such structures as these, in association with suitable porosity conditions, might give rise to commercial production in the future. It is pointed out that the average thickness of the sandstone cannot be great and any successful wells would not be very prolific.

In addition to the map of the area, a section compiled from well logs is given.

J. A. G.

246. Mechanics of Low-Angle Overthrust Faulting as Illustrated by Cumberland Thrust Block, Virginia, Kentucky, and Tennessee. J. L. Rich. *Bull. Amer. Assoc. Petr. Geol.*, 1934, **18**, 1584–1596.—The study of the Cumberland thrust block on the outer limits of the Appalachian overthrusting is used to demonstrate the importance of thrust movements taking place along bedding planes. The importance of recognising that faults and folds within the thrust block are probably superficial, when considering these structures in relation to oil and gas, is also pointed out.

It is considered that the thrust plane followed a zone of easy movement in a shale until frictional resistance became too great; it then sheared diagonally up across the bedding to another shale, and followed that for several miles; finally, it sheared across the bedding to the surface. Evidence that the thrust plane is essentially shallow is given by the exposure of "fensters" in the thrust block. S. E. C.

247. Geology and Economic Significance of the Oklahoma City Field. B. B. Zavoico. *World Petr.*, 1935, **6**, 11–25.—The geology, history, and development of the oilfield are reviewed. The field, with its oil recovery to date of nearly 250,000,000 brls. and a recoverable reserve still of some 95,000,000 brls., is one of the most outstanding areas in the Mid-Continent. It was developed and produced in a highly wasteful manner, being over-drilled in its richest pay sand, the Wilcox, with subsequent waste of gas. The waste of capital due to unnecessary drilling has been estimated at $32,500,000. Some particulars are given of drilling costs in the field in 1934, of producing wells, and of companies operating in the area. Drilling practices are outlined, and an analysis of typical crude oils obtained in the field is presented. W. W.

248. Exploration Work in Rumania. F. W. Penny. *Oil Weekly.* 28.1.35, **76** (7), 97.—Until recently Rumania's production has been obtained from structures in or near the foothills of the southern Carpathians, but now tests are being made on the great plain to the south. The deep Chiturani well is believed to have reached the Meotic at a depth of 9000 ft., a depth greater than was expected from the belief that the location was on a simple anticline. The flank of the structure was found to be very steep, and probably overthrust from the north, and the structure is not now viewed favourably.

The Ditesti well was abandoned at 3300 ft., still in the upper Pliocene, and appears to have been located in a geosyncline as a result of a misinterpretation of geophysical data.

The Dragomiresti well in the Dambovita valley reached the Meotic at 5500 ft., showing that the dip away from the foothill structures is gentle, and thus the oil series is within reach of the drill. High-pressure Meotic sands were encountered, and it is hoped that an important field may be discovered in the neighbourhood.

The Bucsani wildcat found the Meotic at 4500 ft., and oil-sands capable of giving a 1200-brl. well. This Bucsani anticline is gentle and extensive. G. D. H.

249. Buried Mountain Ridge in the U.S.S.R. Anon. *Oil News*, 1935, **37**, 89.—Professor Karpinsky believed that a buried mountain range lay beneath the Kalmyk-Salsk steppes and the bordering land of the Caspian Sea. Geophysical work and drilling have proved the existence of this ridge, which is revealed in the north-west by the Donetz coal range and to the south-east by the mountain chain of Mangyshlak. Signs of oil and gas are known in the Kalmyk steppes, and hope is entertained that this may prove an important oilfield such as has been found over buried ridges in U.S.A.

G. D. H.

250. Preliminary Report on Sepik River District, Australia. Anon. *Oil Weekly*, 14.1.35, **76** (5), 35.—Exploratory drilling has revealed oil possibilities in the Sepik River district on the north-eastern coast of Australia, south and a little west of New Guinea. Oil and gas have obtained, but only a few gallons per day of the former. The seepages occur along a fault-plane where they are closely associated with igneous intrusions. The petroliferous series is Mid-Miocene, of shales, grits, sandstones, and limestones, capped by Upper Miocene marls and mudstones. The beds are thrown into a series of parallel folds, and the oil horizons are exposed at Matapua. G. D. H.

251. New Multiple Permeability Apparatus. F. B. Plummer. *Petr. World*, 1934, **31**, 283–286.—Description of a piece of laboratory equipment for the investigation of the physical properties of producing sands, possessing certain advantages for comparative studies of liquid flow. Essential features of the apparatus are: (1) Production of the viscous media through the sands very closely approximates the actual production of oil in a miniature oil well, so that all flow conditions, such as heading, stopcocking, etc., can be reproduced and studied; (2) samples can be thoroughly cleaned and the fluid changed without removing the cores from their settings; (3) a series of viscous media ranging from air to the heaviest oils can be run through the sand samples in rapid succession; (4) four or more samples can be investigated at the same time and under exactly the same conditions; (5) core settings are designed to hold standard cores obtained from wells.

Experimental results are given, and it was found that both linear and radial permeabilities were greatly increased by cleaning the cores with distilled water and by air injected at rather high velocities. Results indicated that if the actual permeabilities of the semi-consolidated deposits as they exist in the sub-surface are to be determined, excessive pressures of the gas or fluid should not be employed in the test. Data taken under conditions of high pressure and rapid flow lead to permeability values higher than those that actually exist in nature.

The results of the tests described in this article lead to a conclusion well known to oil operators: that the permeabilities of the sands adjacent to producing wells can be substantially increased by allowing the well to produce at a maximum rate for a time after it comes in, and the longer the time and the higher the rate of flow, the better. Radial permeability is appreciably less than linear permeability. W. W.

Class 300. Development and Production.

252. Scientific Field Development. A. C. Rubel. *Petr. Eng.*, Dec. 1934, **6** (3), 22.—A description is given of the Schlumberger Electrical Coring Device, which enables the nature of the formation to be determined electrically.

Sketches are given which show clearly the manner of operation.

In addition to the determination of the type of formation penetrated, it may be necessary to determine accurately both the direction and degree of any deviation that

may occur. For this purpose a number of instruments have been devised that are a regular part of drilling operations.

A gun perforator has effected noteworthy economy wherever it has been used in perforating casing to enable production to be drawn from sands which have probably been cased off.

Where water encroachment is a serious matter, the location of the point of entry becomes a problem. This has been solved to a great extent by the use of a "water witch." Two methods are explained in the article. L. V. W. C.

253. Progress Marks Development of Kansas Fields. K. C. Sclater. *Petr. Eng.*, Dec. 1934, **6** (3), 44.—Many progressive features are noticeable in the development of the Kansas Fields.

The State regulations and control of oil production are worthy of mention, since great effort is being made to see that these regulations are complied with and that allowables are equitable.

Potential is determined in the manner in which the well is normally produced—that is, flowing wells to be produced by natural flow, pumping wells by pumping, etc. Swabbing and gas lift are not permitted in making a potential test. The deviation of the test varies with the size of the well.

All wells are being drilled by rotary to the top of the producing horizon, but most wells are drilled in with cable tools. At least one company is drilling-in with rotary. When a depth of about 2100 ft. is reached the mud is thoroughly conditioned and aquagel added. A close check is then kept on the mud until the well is completed.

Portable steel drilling-in units are in use, and considerable saving in time is shown. L. V. W. C.

254. Equipment and Operating Trends in Kansas Fields. V. D. Bennett. *Petr. Eng.*, Dec. 1934, **6** (3), 58.—The most important trends in surface equipment and production practices in the Kansas fields concern cable tool drilling-in units, surface pumping equipment, and well servicing equipment.

The pumping equipment is chosen after the potential test is made. The trend is toward the use of individual pumping units, the size of the unit being determined by the capacity of the well and the estimated load that the unit will be required to handle.

Various types of drilling-in units are in use in these fields, and descriptions of some of these are given in the article.

Practically every type of gear-driven individual pumping unit is represented in the Kansas Fields, and pulling winches of the most up-to-date patterns are in operation everywhere. L. V. W. C.

255. Kittrell Field. N. Williams. *Oil & Gas J.*, 3.1.35, **33** (33), 9.—The Kittrell Field in Southern Houston County has once again become the centre of attention as a result of a well which caught fire and ran wild for a period of seven days.

Prior to sanding up, the well cratered, and arrangements were made to drill a relief well with a hole deflected to a point near the bottom of the wild producer.

A blow out at this well was entirely unexpected, since no particular indication had been given of a very high gas pressure, and, in addition, casing had been cemented through the gas zone. The gas–oil contact, however, was probably so sharp at this point that the gas broke through.

Extremely irregular conditions have been found in the drilling of the field, although the sands are all approximately the same depth and the wells within a close area.

Only small, light equipment has been used in drilling up the area. L. V. W. C.

256. Controlled Directional Drilling. J. C. Albright. *Petr. Eng.*, Jan. 1935, **6** (4), 21.—Controlled directional drilling of wells has been reduced to a practical science, as is evidenced by the success of the drilling under the ocean from land sites at Huntington Beach, Cal.

More than fifty wells are being drilled by controlled directional methods during the drilling boom, and the maximum drift angle may be as much as 68°.

The particular formation to be drilled will determine which of the two different applications of controlling the drift will be employed in starting the deflected hole.

In a formation consisting of shale or other easily drilled formation, a knuckle joint is used. This is a patented tool having a universal joint incorporated in the design immediately below a tool joint.

If the formation presents another set of conditions when the hole is started, a whipstock is used to begin the deflection of the hole.

Surveys are made to ensure that the direction of the hole has been properly changed. L. V. W. C.

257. Modern Tools Help Deep Fishing Job. F. Swindell. *Oil Weekly*, 7.1.35, **76** (4), 31.—Six months of constant fishing in the second deepest test in the world is apparently to be successfully terminated.

When coring at 9986 ft. a bottom hole pressure of something approaching 5000 lb. was encountered, and necessitated the use of heavy mud to prevent a blow out.

As the production did not come up to expectations, the hole was continued until a depth of 11,230 ft. was reached.

At this depth drill pipe parted 72 stands below the derrick floor, but the string was successfully fished out. Shortly after this the pipe and tools came fairly off bottom to a point about 2 stands up, where the tools stuck and circulation ceased. This was the beginning of more than six months' fishing.

Every known rotary fishing tool has been used in this operation, and it is hoped that the well will have a production of between 500 and 1000 brl. if it is brought successfully into production. L. V. W. C.

258. Underground Surveying in Drilling Operations. W. A. Sawdon. *Engineering*, 1935, **139**, 53–55.—An account of the instruments employed in the Huntington Beach Field, California, for surveying oil-wells, and of the manner of their application. A photograph of the field accompanies the article. W. W.

259. Plural Drilling Method in California. L. P. Stockman. *Oil & Gas J.*, 20.12.34, **33** (31), 14, 35.—A multiple type of drilling has been perfected, and is being used successfully in tideland development. Due to the elimination of costly foundations and other surface equipment by the utilisation of a common rig and primary hole for the drilling of two or more wells, drilling costs have been greatly reduced.

The procedure followed in drilling these plural wells is to land a large-size conductor string usually about 50 ft. of 48-in. pipe. Then an 18⅝-in. temporary guide pipe is set in an inclined position through the larger pipe, driven a few feet below the conductor pipe shoe, and then anchored in the cellar. A 17½-in. hole is then drilled to the point where a string of 13⅜-in. casing is to be landed and cemented. After the drilling of this hole the 18⅝-in. guide is stripped away and removed from the hole. The crown block, rotary table, and drawworks are shifted off centre, but after the 17½-in. hole has been safely directed to the desired course these are returned to their normal position.

The procedure is the same with each additional well drilled in the primary hole as that followed with the first well. L. V. W. C.

260. Diesel-driven Turney Outfit on Test Well. Anon. *Petr. World* (LA), 1935, **32** (1), 51.—Short description of the new Turney four-speed drawworks to be used for wild-catting in the Texas Gulf Coast, where depths will run between 6000 and 7000 ft. through fairly soft formations, in which bad, heaving shale deposits are prevalent. The drawworks is an all-gear-driven machine with air-actuated clutches and brakes. The variable speed is an outstanding feature of the machine, and permits the driller to change the speed of the drum instantly to either a higher or lower speed while running under full load, even with the engine running at high speed. The line speed is variable from 350 to 2160 ft./min., and the table speed from 15 to 200 r.p.m. W. W.

261. Specification of Portable Rotary Drilling Unit. C. White, Jr. *Petr. Eng.*, Jan. 1935, **6** (4), 86.—A complete specification of the Franks Portable Rotary Drilling unit is given. This rig is capable of drilling wells to at least 4000 ft., using 3½-in. special full-hole drill pipe. L. V. W. C.

262. Parallel Operation of Electric Generators. W. C. Lane. *Petr. Eng.*, Jan. 1935, **6** (4), 18.—A description is given, in a non-theoretical manner, of the parallel operations of both D.C. and A.C. generators.

Paralleling is a method of operation in which an additional generator is added to that already in use, in such a way that the units may be treated as a whole and the generators connected to the common load.

The best practice is to instal a minimum number of generators in permanent installations. In less permanent installations, where loads frequently increase and decrease sharply in a comparatively short time, it is advisable to instal a plurality of small generators and to operate them in parallel.

Parallel operation may be used to advantage on drilling rigs where the energy is produced by portable D.C. or A.C. gas or oil electric generating units.

Wiring diagrams for paralleling are given. L. V. W. C.

263. Motorised Drilling on Diesel Electric Barge. Anon. *Oil & Gas J.*, 3.1.35, **33** (33), 38.—Oil has recently been discovered in the extreme eastern portion of Venezuela in the region occupied by the delta of the Orinoco River. For use in this area a Diesel-electric power barge, together with motorised drilling units, have been ordered.

A complete description of the unit and the layout is given in the article. L. V. W. C.

264. Care of Modern Steam-generating Plant from the Water Side. R. J. Glinn. *Engineer*, 1935, **159**, 131–134; *Engineering*, 1935, **139**, 129.—The author discusses the treatment and control of boiler water and plant failures which arise from feed-water troubles. W. W.

265. Relation of Drilling Mud and Cementing. C. P. Parsons. *Oil & Gas J.*, 3.1.35, **33** (33), 87.—Some of the important points relative to the steps of establishing circulation and cementing long strings of casing in deep wells are dealt with in this article.

The failure to establish circulation raises a number of points concerning certain physical properties of drilling fluids. A thin mud allows circulation to be more easily established than a thick mud, but the natural conditions in a well may result in the mud being built up with admixtures, or in some areas the natural mud may be loaded with an excess of natural colloidal and viscous materials picked up when drilling. The greater the amount of solids in the drilling fluid the lower becomes the fluidity.

A combination of excessive consistency of the mud and mechanical restrictions behind a long string of pipe may prevent establishment of circulation. In addition, the gel strength of a mud has an important bearing on this same factor. Gel strength is a physical property of a drilling fluid to stiffen into a gel-like structure as soon as agitation is stopped. When agitation is resumed, the structure is broken. The resistance offered by this gelling may become troublesome, and must be reduced by some means. The addition of quebracho and caustic soda will accomplish this reduction.

The use of flush joint casing will assist in reducing the mechanical restrictions behind a string of casing.

The development of cementing equipment is no longer confined to surface equipment, and present tendencies are towards developing sub-surface equipment.

A number of the latest methods for cementing and the equipment used are described in the article. L. V. W. C.

266. Pressure Drilling and Controlled Mud Fluid in Completing Deep Holes. L. G. E. Bignell. *Oil & Gas J.*, 3.1.35, **33** (33), 34.—Although 10 deep tests all below 10,000 ft. in depth have been listed, none of these has yet been successful in completing the hole and bringing in a commercial producer.

The deepest producing field in the world is the Big Lake Field, Reagan County, Texas, the wells here being from 8100 to 8900 ft. deep.

The first well in this field was drilled to 8525 ft., when high pressures and large volumes of gas prevented deeper drilling with cable tools. This well produced water-white oil.

In order to drill to the lower heavy oil stratum, it was found necessary to use a combination of pressure drilling and fluid column control. The pressure in the gas zone was 1900 lb., and even with clear water for drilling fluid, it was found impossible to penetrate this zone successfully, as the column of water at 8200 ft. exerted a pressure of 3600 lb. To overcome this difficulty high-pressure gas was introduced down the drill pipe simultaneously with the water from the pumps. With 800 ft. of gas per barrel of drilling water, the resultant pressure on the bottom at 8200 ft. did not exceed 1900 lb./sq. in.

With this reduced pressure the formation was permitted to discharge its gas into the hole, and so remove the cuttings to the surface. The products from the well are all discharged directly into a separator, in which the cuttings and water are removed. A second trap is provided to separate the oil and gas, and the gas is passed to a third to be measured.

The well-head fittings consist of "Hydril" pressure control outfit which permits the drill pipe to be run in and withdrawn without releasing pressure.

A blow-out preventer is also installed. L. V. W. C.

267. Pressure Time Chart taken during Cementing. W. A. Sawdon. *Petr. Eng.*, Jan. 1935, **6** (4), 27.—A recording pressure gauge to automatically record time and pressure has been developed for use on cementing jobs.

Such a record affords a ready check on the operations. The mixing time is clearly indicated, and the time it takes to pump the cement is recorded with the pressure applied at every moment.

Accidents will be shown up on the chart, as will also the time at which they occur. L. V. W. C.

268. Deflected Relief Hole is Used to Extinguish Burning Oil Well. J. D. Hughes. *Oil Weekly*, 14.1.35, **76** (5), 27.—The burning and cratered Sinclair Prairie Oil Company's Seeligson 1 in the Premont Pool, Texas, was successfully extinguished and killed by circulation established from a deflected relief well.

After unsuccessful attempts to cap the well and bring it under control, it was decided to drill a relief well, deflected to the first sand at 2365–2384 ft. under the 9⅝-in. casing which had been set at 2356 ft.

Owing to the failure to land the 16-in. string, it was necessary to set 13⅜-in. casing at 400 ft. This left only 1890 ft. of vertical distance in which to obtain a lateral displacement of 386 ft., the distance from the cratered well of the location of the relief well.

The first 7½-in. patented removable whipstock was oriented at 475 ft. in 12½-in. hole to obtain the desired direction and to start the deflection angle. From this point on 9½-in. hole was carried. At a depth of 1072 ft. the angle had been built up to 16 deg.

Control of the hole was maintained by the use of a single-shot surveying machine run on a sand line used every 50 ft.

At a depth of 2161 ft. coring for a casing seat began, and continued to 2215 ft. At this point the bottom of the relief well was 43 ft. from the objective laterally, and distant vertically some 190 ft. The 9⅝-in. hole was then reamed to 14 in. diameter and 9⅝-in. casing cemented with 250 sacks of cement.

The plug was drilled out, and when a sufficient distance had been drilled into the objective sand, the calculated distance between the two holes on the same horizontal plane was a little more than 5 ft.

Blow-out preventers were sealed, two mud pumps were compounded, and a peak pressure of 1200 lb. was indicated. Within 3 mins. circulation was established between the two holes.

Eventually enough mud and water were associated with the discharge gas that the flame was snuffed out. L. V. W. C.

269. Electrical Pumping Progress in Kansas and Oklahoma. G. H. Weckel. *Oil Weekly*, 24.12.34, **76** (2), 19–20.—The use of electric power for oil-well pumping and drilling in the Kansas fields is not new. It was first used in the boom days of the Augusta and El Dorado fields of 1917 and 1918. The electrification of the pumping wells in these two fields was the first major oilfield electrification project in the United States.

The desire of operators to equip their wells with pumping equipment that could also be used for pulling rods and tubing retarded greater application of pumping units. Since 98% of the running time is spent in pumping the well, and only 2% in pulling rods, portable high-speed pulling machines have been designed, and the greatest efficiency is thus possible with the pumping equipment.

Geared motors have recently been applied to oil-well pumping in the Mid-Continent field, and slow drive-shaft speeds are thus obtained from high-speed motors.

Appreciable saving can quite often be made by operating with reverse crank rotation.

This is governed by the load on the well and by the angle made by the pitman and walking beam the moment the load is picked up.

Burning-out of pumping motors due to overload is entirely unnecessary if equipped with the proper overload protective device. Should the rods part, the overload device will act to shut the well down. L. V. W. C.

270. **Kansas Lease Pumped by Oil Electric Unit.** W. C. Lane. *Oil Weekly*, 7.1.35, **76** (4), 33.—The power plant for the operation of the Stanolind Oil Co.'s field in the Ellinwood area is located at a spot about 3 miles from Ellinwood. It consists of a 100 kw., 480-v., 3-phase, 60-cycle, 900-r.p.m. generator belted to a 150 h.p., 2-cycle, 225-r.p.m. semi-Diesel oil engine. The exciter is mounted on a bracket attached to the end housing of the generator. The switch-board equipment includes a main disconnect knife switch, two industrial type feeder oil-circuit breakers, etc. About 500 v. is carried at the plant.

Thirteen wells are operated from the plant at present, and it is planned to attach three others to an extension of one of the main feeders.

All rod-pulling jobs are operated by a winch mounted on a truck. L. V. W. C.

271. **Mechanical Down-time Analysis Advances Pumping Technique.** I. F. Bingham. *Oil Weekly*, 24.12.34, **76** (2), 22, 24–28, 30.—This, the final article on down-time analysis (cf. Abstrs. 29, 131), deals with engines, miscellaneous surface equipment, and a general summary of the entire series of articles. This summary tends to show that the facts brought out by this investigation are of considerable value.

As in the previous articles, comprehensive tables are given of the down time of all makes of gas engines, all makes of clutches and countershafts, and all makes of beam hangers. A final table showing a summary of all mechanical down time, together with a number of graphs, concludes the article. L. V. W. C.

272. **Paraffin Accumulation in East Texas Reduced in Several Ways.** B. Mills. *Oil Weekly*, 7.1.35, **76** (4), 29.—The depositions of paraffin in many areas in the East Texas field have been checked or prevented by the full utilisation of natural well forces.

From a study of the nature of paraffin in the oil, it has been found that oil kept in motion at a reasonable temperature will not result in a high percentage of paraffin deposit unless there are fairly definite breaks or dry spaces in the fluid flow. For a thick deposit of paraffin it is necessary for the dry spaces to occur many times at a given place.

Where it is possible to maintain the tubing string full of oil, the paraffin accumulations will be reduced.

It has been determined that paraffin does not precipitate principally from the body of the oil, but occurs after the gases and lighter fractions evaporate or leave the oil. Production methods must therefore be changed to reduce depositions.

Many of the flowing wells in the East Texas Field are producing on a small choke, and this, coupled with a high back pressure, causes the gas that has left the oil to build up a head resulting in surging in the upper part of the tubing. Each time the fluid level rises and falls a small deposit of paraffin results. Once the oil is saturated with gas at from 1000 to 1500 ft. from the surface, it is necessary to find some method that will cause it to give up the smallest amount of gas above the latter depth.

Wide-open flow results in a smaller accumulation of paraffin than does a slow flow.

Scrapers and chemicals have been used with beneficial results, but steam has not been very successful. L. V. W. C.

273. **Acid Treatment in Kansas Fields.** L. C. Morgan. *Petr. Eng.*, 12.19.34, **6** (3), 48.—The author has attempted a correlation between bottom-hole consideration and field practice, using examples from Kansas Fields.

The theoretical classifications of Herold are taken, and the utilisation of energy in each of the three types of reservoirs is considered in conjunction with the theoretical study of acid treatment.

A description of a method known as the balanced column method is given, together with sketches.

The author concludes with a comprehensive classification of acid treatment methods. L. V. W. C.

274. System of Treating Cut Oil. J. C. Albright. *Oil Weekly*, 31.12.34, **76** (3), 20–22.—The production from certain wells in the Santa Fe Springs field requires elaborate methods to separate the oil from the basic sediment and water.

The Union Oil Company operates two similar systems, both requiring the application of heat in addition to the introduction of treating compounds.

One system uses heat obtained from the exhaust steam of reciprocating pumps, in addition to line steam. The other system employs direct heating by the transmission of heat through tubes similar to processes used in skimming units. In neither case does the heat come into contact with the oil.

The two systems are described in some detail in this article. L. V. W. C.

275. Removal of Small Quantities of Hydrogen Sulphide from Gas. J. C. Albright. *Oil Weekly*, 24.12.34, **76** (2), 31–34.—Natural gas from wells in California must not contain more than a trace of hydrogen sulphide as determined by the lead acetate strip method as specified by the California State Railroad Commission. The sensitivity of this test is approximately 0·30 grain H_2S per 100 cu. ft. of gas. Any excess amount of hydrogen sulphide must be removed from the gas before it can be passed through the mains for distribution to the cities.

Iron oxide was decided on as the most practical and economical of the several methods considered as a purifier for the gas.

The unit used for the purification of the gas is described with sketches.

L. V. W. C.

276. Effect of Different Production Rates on Pressure Distribution in East Texas. C. E. Reistle, Jr. *Petr. World*, 1934, **31**, 329–330; *Oil Weekly*, 26.11.34, **75** (11), 26.—A study of the distribution of the pressure throughout the reservoir during the past year shows conclusively that not only do higher rates of production cause a more rapid decline in the average reservoir pressure of the field, but also cause a higher pressure gradient across the field. This means that not only will it require a longer period of time for the average reservoir pressure of the field to decline to any given value, if the rate of production is decreased, but at the same time the east half of the field will have a higher pressure at that time than if the field were operated at a higher rate of production. W. W.

277. Vacuum During Re-pressuring. C. E. Morris. *Oil Weekly*, 14.1.35, **76** (5), 25.—Little or no pressure can be held on the gas-gathering lines from the casing-heads of the wells in the Bush City Pool and at the same time obtain production. Oil recovery is retarded with a back pressure of only 1 lb.

Vacuum and air re-pressuring were applied at about the same time. At the time of application there was only enough gas from the casing-heads to operate the unit, and air was used as the re-pressuring agent. Almost at once there was an increase in the supply of gas, and eventually only gas was re-cycled.

The property has 116 wells and only 9 air wells. Re-pressuring is not carried out too thoroughly, for fear of the wells blowing through necessitating the suspension of the vacuum. Of this number only one well has channelled.

From a test made it was found that the air travelled through the sand at about 1 ft. in 3 days at 175 lb. pressure. L. V. W. C.

278. Waste of Natural Gas in the Panhandle of Texas. R. D. Parker. *Oil Weekly*, 7.1.35, **76** (4), 35; 14.1.35, **76** (5), 27; 21.1.35, **76** (6), 31.—These articles deal with the problem of gas wastage as applied to the Texas Panhandle. A discussion is given of the state statutes influencing operating methods and reservoir pressure, and the effect of pressure withdrawals on the future and present reservoir pressure is dealt with.

In the second article the author enumerates the extent of the gas supply and lists the development of the pipe-lines to market. The question of the ratable taking of gas from the field is also investigated.

In the concluding article the author gives his conclusions for remedying such waste.

L. V. W. C.

279. Safety Departments. B. Mills. *Oil Weekly*, 21.1.35, **76** (6), 24.—Reports on accidents in the petroleum industry for the year 1934 indicate that the frequency of such accidents is in the majority of cases higher than for the previous year. Many companies will, however, show an improvement.

There are a number of reasons for the increase in accident frequency, among them being the fact that more persons were employed during 1934 than during either 1932 or 1933. In addition, the Government plan to distribute jobs to the greatest possible number of persons resulted in many men with limited experience being employed. The oil industry took large numbers of these men inexperienced in safety measures.

Many large oil companies have safety departments, and it is these companies which show a reduced accident rate. Due to the supervision undertaken by these safety departments, these companies can show a definite saving in the cost of lost-time accidents. L. V. W. C.

280. Patents on Drilling. W. H. Maxwell. U.S.P. 1,982,919, 4.12.34. Well Pump.

E. L. Baker. U.S.P. 1,983,016, 4.12.34. Well Screen.

W. L. Clark. U.S.P. 1,983,217, 4.12.34. Well Flowing Apparatus.

L. E. Garfield. U.S.P. 1,983,283, 4.12.34. Bearing for Drill Cutters.

S. H. Grinnell and A. C. Rubel. U.S.P. 1,983,287, 4.12.34. Drilling Structure and Circulating Pump.

T. L. Scott. U.S.P. 1,983,315, 4.12.34. Mounting for Reamer Cutters.

T. F. Scott and L. E. Garfield. U.S.P. 1,983,316, 4.12.34. Three-Core Bit.

G. A. Zeidler. U.S.P. 1,983,428, 4.12.34. A method of drilling wells by driving down a line of well pipe with a driving point at the lower end and a length of screen pipe to enable soundings to be taken to determine the yield at any given point.

F. J. G. Neumann and W. R. Hanbred. U.S.P. 1,983,483, 4.12.34. Apparatus for making Geophysical Measurements.

L. T. Pedigo. U.S.P. 1,983,488, 4.12.34. Reamer.

L. T. Pedigo. U.S.P. 1,983,489, 4.12.34. Well Pump.

J. Penrod. U.S.P. 1,983,490, 4.12.34. Well Pump.

E. V. Crowell. U.S.P. 1,983,523, 11.12.34. Swab.

A. E. Johnson. U.S.P. 1,983,545, 11.12.34. Rotary Well Drilling Apparatus.

P. J. Bowman and W. J. Branson. U.S.P. 1,983,655, 11.12.34. Pitman Construction.

J. H. Howard and J. H. McEvoy, Jr. U.S.P. 1,983,854, 11.12.34. Casing Head for Wells.

I. J. McCullough. U.S.P. 1,983,865, 11.12.34. Rotary Jar.

G. A. Humason and M. Manning. U.S.P. 1,983,938, 11.12.34. Casing Head Equipment.

R. C. Baker. U.S.P. 1,984,107, 11.12.34. Drill Pipe Float.

H. C. Otis. U.S.P. 1,984,230, 11.12.34. Well Tubing Plug.

R. E. Beehtold. U.S.P. 1,984,328. 11.12.34. Valve Structure.

W. C. Babin. U.S.P. 1,984,622, 18.12.34. Combination Make-up and Break-out Tong.

F. W. Harrington. U.S.P. 1,984,741, 18.12.34. Float-operated Valve for Oil Wells.

C. R. Wagner. U.S.P. 1,984,903, 18.12.34. Process for Removing Salt Compounds from crude oil drawn from wells which have been acid-treated. L. V. W. C.

Bat. Petm. Mij., Dutch P. 63,904, 13.1.33. In clay-washing used in drilling, the concentrations of Ca and Mg ions are brought beyond coagulation values. Protective colloids are added to counteract coagulation by alkali ions.

Bat. Petm. Mij., Dutch P. 64,074, 26.1.33. An improved clay-washing for drilling purposes is obtained when the smallest particles are previously separated from the clay. P. C. K.

Class 400. Transportation, Storage and Distribution.

281. Lone Star Completes New Texas Line. F. H. Love. *Petr. Eng.*, Dec. 1934, **6** (3), 26.—The 12-inch 70-mile line from the Long Lake Gas-field of Anderson County to the company's main line near Waco, Texas, is the first major pipe-line of the Lone Star Gas system to be entirely electrically welded.

Practically the whole of this line was salvaged from unused portions of the Lone Star's system in Oklahoma and Texas. All joints were roll welded, and the complete line was coated with hot enamel and wrapped with asbestos felt as a protection against corrosion.

As the pipe was old, there were many uneven ends that required trueing up, and to overcome this an interesting piece of equipment was devised. It consisted of a steel band that clamped around the pipe. This band was provided with a hinge and a latch, and when in place fitted the pipe snugly, so that the cutting torch performed a smooth job and resulted in a perfectly square joint.

All joints were tested up to 50–60 lb. air pressure.

The pipe was given a final cleaning and a coat of primer prior to the application of hot enamel.

Holiday detectors were used to locate pin-holes or breaks in the enamel coating.

A slack loop was left to every 400–500 ft. in level ground and at varying distances where the topography of the country was irregular.

Gate valves were located every 6–8 miles, and set in concrete boxes.

The gas is under sufficient pressure at the wells not to require compressor stations to boost it to the junction near Waco. The wells are all equipped with bottom-hole chokes to control the delivery of gas without freezing. L. V. W. C.

282. Pipe-line System in West Kansas. L. G. E. Bignell. *Oil & Gas J.*, 27.12.34, **33** (32), 48.—Extensive additions are being made to the pipe-line system of the Stanolind Pipe Line Co. in Kansas to deal with the anticipated increased production of oil in the Western Kansas area, where new development work is being carried on. Acid treatment of wells in many fields is expected to increase the potential of the area.

Lines are being looped, and modern stations are being erected to cope with the expected increase. L. V. W. C.

283. Re-conditioning Lines in Salt Marsh Districts. L. E. Bredberg. *Oil & Gas J.*, 3.1.35, **33** (33), 8.—Owing to the salt nature of the ground and water surrounding pipe-lines in coastal areas, cleaning and re-conditioning every 2 or 3 years are essential. Barnacles frequently form coatings of 2 to 4 ins. on such lines. At Refugio Harbour Island the pipe-line is cleaned, corrosion pits are repaired by welding, and the line is given two coatings of grease, three wrappers, and two coatings of paint. It will eventually be painted with aluminium paint, which keeps the temperature of the oil 6–8° lower in the summer months. An innovation in the repairing of the line consisted of buoying it between pairs of empty steel drums wired together at intervals of 8 ft. The drums were covered with felt to protect the pipe-line coatings, the line resting between the two drums and being rolled off when ready for laying.

284. Corrosion of Ferrous Metals in Acid Soils. I. A. Dennison and R. B. Hobbs. *Bur. Stand. J. Res.*, 1934, **13**, 125–150.—Efforts are being made to correlate corrosiveness of soils towards buried pipe specimens, with their chemical and physical properties.

A definite relationship has been obtained between the average rates of pitting of ferrous specimens buried for 8–10 years and the total acidity of the soils. The correlation with the *p*H values of the soils concerned was far less marked.

Laboratory experiments using a synthetic soil of quartz flour with 10% agar have shown a correspondence between the loss in weight of steel specimens and the total acidity of the soil.

The effect of acidity is attributed to its action in preventing the formation of a protecting layer of hydroxide.

The pitting factor defined as the ratio of maximum depth of pits/average depth of penetration appears to be roughly proportional to the ratio of uncorroded/corroded areas on a metal surface.

Permeability of soils, excluding sands, could be correlated with the pitting factor, and this permeability was gauged by several tests, including mechanical analysis, water-holding capacity, moisture equivalent, apparent sp. gr., volume of voids, dispersion ratio of silt and clay.

Certain impervious soils show very low pitting rates. D. L. S.

285. New Pump Set-up Produces Economies. Anon. *Petr. World* (LA), 1935, **32** (1), 33.—Two gasoline engine-driven centrifugal pumping units, installed by The Associated Oil Co. at its Monterey marine terminal, California, give increased capacity, greater flexibility, and lower operating costs than the original electric motor-driven rotary pumps in pumping the now lighter gravity oil through a 16-in. submarine line

to tankers. Each of the new units consists of a 230-H.P. 6-cyl. gasoline engine direct-connected to a single-stage centrifugal pump. The pumps are connected in parallel, and each is capable of delivering 4000 brls./hour, operating at a speed of 1550 r.p.m. It is estimated that the savings will pay out on the investment within two years. In arriving at a decision regarding the driving units—*i.e.* electric motors, Diesel engines, or gasoline engines—consideration of the load factor, initial cost, operating expense, and fuel available showed that gasoline engine-driven centrifugal pumps would be the most practical for this service. W. W.

286. Pumping Equipment for the Iraq–Mediterranean Pipe-line. Anon. *Engineering*, 1935, **139**, 116.—Some details are given of the Worthington-Simpson pumps installed in the pumping stations on the Iraq–Mediterranean oil pipe-line. W. W.

287. Iraq–Mediterranean Oil Pipe-line. Anon. *Engineer*, 1935, **159**, 75–76, 91–93, and 118–119; *Engineering*, 1935, **139**, 55–58.—Descriptive articles on the Iraq Petroleum Co.'s pipe-line. Pages 91–93 of the *Engineer* deal with the main and auxiliary pumping plants and the general station and pipe-line equipment. Pages 118–119 of the same publication describe the de-gassing stations and the provisions for oil storage and transfer which have been made at Tripoli and Haifa. W. W.

288. Nomographic Charts for Measuring Flow of Viscous Fluids. H. V. Beck. *Oil Weekly*, 21.1.35, **76** (6), 27.—Nomographic charts are given for measuring the flow of viscous fluids with orifices, nozzles, or venturi tubes. L. V. W. C.

289. Measuring Natural Gasoline by Meter. C. D. Gard. *Petr. World* (LA), 1935, **32** (1), 45.—Describes how the orifice meter, and more recently the displacement meter, have been used to overcome the disadvantages of tank gauging; errors in measurement are remarkably low. W. W.

290. Nomographic Charts for the Measurement of Liquids in Tanks. M. G. Van Voorhis, *Nat. Pet. News*, 9.1.35, **27** (2), 22.—The article describes the use of two charts for the measurement of liquids in bulk. One chart is for volumes in vertical, flat-ended cylindrical tanks, and the other for horizontal tanks of any symmetrical shape. Volumes are determined directly by referring the depth of the liquid in the tank and the significant dimensions of the tank to scales on the charts. The charts are reproduced in the article, and are available through the publishers. H. G.

Class 500. Properties and their Determination.

291. Physical Constants of Propane. E. B. Cox. *Oil & Gas J.*, 3.1.35, **33** (33), 16.—A table of the physical characteristics of propane, collected from various sources, is presented, the reasons given for the choice of certain figures being outlined. The more important of the preferred figures are: *Mol. wt.* 44·08; *B. pt.* at 760 mm. Hg, − 43·8° F., at 30 mm. Hg, − 43·7°; *Vap. press.* at 60°, 70°, 100°, 105°, 130° F. resp. 107·2, 124·2, 186·6, 199·1, 269·6 lb./sq. in. abs.; *Crit. Temp.* 212·2° F.; *Crit. Press.* 634·3 lb./sq. in.; *Crit. Vol.* 0·06896 cu. ft./lb.; *Sp. Gr.* (liquid at 60° F. and at vap. press.) against H_2O at 60° F. 0·5116; *Sp. Gr.* (vapour at 60° F. and 14·73 lb. abs.) against air 1·5464; *Gross Cal. value* (liquid) 21,493 B.Th.U./lb., (vapour) 2555 B.Th.U./cu. ft; *Limits of inflammability* 2·3–9·5%; *Sp. heat* (liquid at 60° F.) 0·658 (vapour at 60° F. and 14·73 lb.) 0·404; *Latent heat* at B. pt., 183 B.Th.U./lb., 780 B.Th.U./gal.; *Cubic feet* per gal. of liquid at 60° F., 36·05; *Cu. ft./lb.*, 8·451. C. L. G.

292. Specific Heat of Liquid Pure Hydrocarbons and Petroleum Fractions. L. P. Gaucher. *Ind. Eng. Chem.*, 1935, **27**, 57.—This paper gives an attempt to correlate the published data on the specific heats of pure hydrocarbons and petroleum mixtures. The use of specific gravity alone as a basis of correlation is criticised, and it is shown that pure hydrocarbons can be correlated by an expression combining both specific gravity and boiling-point. Two equations are shown to give suitable correlation:

$$C_p = 0{\cdot}6230 - 0{\cdot}0187\,\frac{T^{0{\cdot}5}}{S^{1{\cdot}5}} + 0{\cdot}000355\,\frac{T}{S^3} + 0{\cdot}00045\,(t - 32) \quad . \quad . \quad . \quad (1)$$

$$C_p = 1{\cdot}323 - 0{\cdot}2005\,\frac{T^{\frac{1}{2}}}{S} + 0{\cdot}0107\,\frac{T^{\frac{1}{2}}}{S^2} + 0{\cdot}00045\,(t - 32) \quad . \quad . \quad . \quad . \quad (2)$$

where C_p is the specific heat at $t°$ F.,

T = b. pt. of liquid ° Rankine,
S = specific gravity of liquid.

Equation (1) was used as a basis for later study of the petroleum fractions, but it is pointed out that Equation (2) is in some ways preferable, since the function $\frac{T^{\frac{1}{3}}}{S}$ is the "characterisation factor" of Watson and Nelson (*Ind. Eng. Chem.*, 1933, **25**, 880).

The study of the results on petroleum fractions indicates that it is preferable to make the slope of the specific heat–temperature line dependent on the gravity of the liquid, and the equation becomes

$$C_p = 0{\cdot}6230 - 0{\cdot}0187\,\frac{T^{0{\cdot}5}}{S^{1{\cdot}5}} + 0{\cdot}000355\,\frac{T}{S^2} + \frac{0{\cdot}00045\,(t-32)}{S} \quad . \quad . \quad . \quad (3)$$

The percentage deviations of actual determinations from various correlations, including equation (3), are given in a table. With the exception of only one set of experiments, those of Gary, Rubin, and Ward (*Ind. Eng. Chem.*, **25**, 178), the determinations have been made at temperatures below 500° F., and most of them have been at a considerably lower temperature than this. Fig. 3 gives good correlation (roughly $\pm$ 5%) with all the published figures except the high temperature values of Gary, Rubin, and Ward, where the maximum error is 14·7%, and the experiments of Henderson, Ferris, and McIllvain on residues and fractions of high boiling-point, where the error is of the same order.

It is concluded that until further developments the equation of Watson and Nelson is the best available. The errors given by it are similar to those of equation (3). In order to facilitate its use, a graph is presented from which the characterisation factor may be easily determined. P. W.

293. Heats of Combustion and of Formation of the Normal Paraffin Hydrocarbons in the Gaseous State, and the Energies of their Atomic Linkages. F. D. Rossini. *Bur. Stand. J. Res.*, 1934, **13**, 21–35.—According to prevailing ideas, heats of combustion of paraffin hydrocarbons in the gaseous state should show constant differences between successive members of the series.

From the data obtained on the first five normal paraffins, the successive differences, whilst not constant, tend to approach a constant value with the increasing number of C atoms. For normal C_nH_{2n+2} (gas), when $n > 5$, the heat of combustion at 25° C. and a constant total pressure of 1 atmos., in gaseous O_2 to form gaseous CO_2 and liquid H_2O is $60{\cdot}40 + n\ (157{\cdot}00 \pm 0{\cdot}08)$ kg. — cal.$_{15}$ per mole. A generalisation is made that in any organic molecule containing a normal alkyl group of more than 5 C atoms the addition of a CH_2 group to the alkyl group to form the next higher N alkyl group results in an increase in the heat of combustion in the gaseous state at 25° C. and 1 atmos. pressure of $157{\cdot}00 \pm 0{\cdot}08$ kg. — cal.$_{15}$ per mole.

Since the synthesis of the hydrocarbon molecules cannot be carried out under conditions permitting accurate calorimetric measurement, their heats of formation are computed most accurately from their heats of combustion.

For this purpose it is necessary to know the heats of formation of liquid H_2O and gaseous CO_2. The standard states of C chosen were β graphite and diamond, and with the data thus obtained it was possible to calculate the heats of formation of all the N-paraffin hydrocarbons in the gaseous state at temperatures of 25° C. and 0° Kelvin.

The energy of dissociation of normal C_nH_{2n+2} (gas) into gaseous C and H atoms is a linear function of N if $N > 5$. The deviations from linearity when $N < 5$ are methane $4{\cdot}81 \pm 0{\cdot}08$, ethane $1{\cdot}59 \pm 0{\cdot}14$, propane $0{\cdot}83 \pm 0{\cdot}19$, N-butane $0{\cdot}46 \pm 0{\cdot}27$, and N-pentane $0{\cdot}13 \pm 0{\cdot}37$ kg.-cal. per mole.

It is shown that for the N-paraffin hydrocarbons and for C and H atoms in their normal state, the energy involved in adding CH_2 to any N-hydrocarbon above pentane at 0° Kelvin is $-\Delta H_0^\circ = (20{\cdot}8 \pm 0{\cdot}9) + D_{CO}$ kg. — cal.$_{15}$ per mole, where D_{CO} is the energy of dissociation of CO at 0° Kelvin. D. L. S.

294. Equilibrium Volatility of Motor Fuels from the Standpoint of their Use in I.C. Engines. O. C. Bridgeman. *Bur. Stand. J. Res.*, 1934, **13**, 53–109.—This paper

gives results obtained by the Bureau of Standards in their investigations of fuel volatility in co-operation with the automotive and petroleum industries.

Volatility is here defined as the temperature at which a given air–vapour mixture is formed under equilibrium conditions at a pressure of 1 atmos. when a given percentage of gasoline is evaporated.

An apparatus designed by T. S. Sligh was employed for this work, and a full description, together with details as to its calibration and the general procedure adopted, are given.

Known mixtures of air and gasoline are supplied to a vaporisation coil maintained at a definite temperature, and the amount of gasoline evaporated is measured. The data thus obtained when corrected to equilibrium conditions represent values which would be obtained in an ideal engine manifold.

Experimental data is given for 38 gasolines and blends covering a wide range of volatility.

A correlation is shown to exist between equilibrium volatility data and distillation data obtained by the standard A.S.T.M. method, and from equations given it is possible to obtain all the necessary volatility information from a knowledge of the distillation ranges.

Volatility data at pressures lower than the standard atmospheric can also be computed with sufficient accuracy from the normal atmospheric values. D. L. S.

295. Critical Solution Temperatures of some Hydrocarbons in Sulphur Dioxide. R. T. Leslie. *Bur. Stand. J. Res.*, 1934, **13**, 589–597.—An investigation has been carried out into the possibility of separating the components of the naphtha fraction of petroleum by the use of extracting agents boiling at about 0° C. In this connection the variation with composition of the solution temperatures in liquid SO_2 of 17 paraffin and naphthene hydrocarbons has been determined.

The results have been correlated with the boiling-points of the hydrocarbons to examine the possibility of separating nearly constant boiling-point mixtures. A few experiments using liquid ammonia have also been made, while several "aniline-points" have been determined for comparison.

In the case of the *N* and *iso*-paraffins from hexane to tetradecane the relation between b. pt. and C.S.T. in SO_2 is nearly linear, whilst the C.S.T. of all the cyclic hydrocarbons except hexahydromesitylene fell below the b.-pt.–C.S.T. line of the paraffins, but showed no marked regularity. From the few experiments made with ammonia, similar results were indicated. It is thus concluded that SO_2 and NH_3 show little promise as extracting agents.

Aniline shows greater differences than the other two solvents in its behaviour to the three classes of hydrocarbons considered. D. L. S.

296. Viscosity of Petroleum Products. W. B. McCluer and M. R. Fenske. *Ind. Eng. Chem.*, 1935, **27**, 82.—This paper describes work undertaken in order to calibrate a Saybolt viscometer in terms of kinematic viscosity (stokes). The method of carrying out the calibration was as follows. The viscosity of the alpha oil standard of the American Petroleum Institute was determined in stokes by means of a special viscometer which was calibrated with water. This viscometer is fully described, and the precautions and possible sources of error involved are also dealt with. The viscometer was standardized with water at 68° F. and 100° F., and the viscosity of the alpha oil also determined at those temperatures. This oil was then used to standardize the two Saybolt viscometers.

The viscosities of 100 different oils were then measured at 100° F. and 210° F. in the Saybolt viscometers and in the modified Ostwald viscometers, the construction and standardization of which were described previously (*Ind. Eng. Chem.*, anal. Ed. 1934, **6**, 231). The results of these experiments were plotted using log. scales and a curve was drawn. The average deviation of the data from this curve was approximately 0·5%; a conversion table prepared from this line is given.

The possibility of constructing equations of the type :—

$KV = AS - B/S.$

KV = Kinematic viscosity stokes.

S = Saybolt seconds.

A_1B = constants.

was examined by plotting the data in the form KV/S against I/S. When this is done, it is found that the data cannot be averaged by a linear relation. Hence either several quadratic equations must be used, or a single equation of more complicated type. For Saybolt viscosities above 5000 the following equation applies :—

$$KV = 0{\cdot}002042\,S + 0{\cdot}4.$$

P. D.

297. Report of the A.P.I. Committee of Viscosity Standards. T. G. Delbridge. *Refiner*, 1934, **13**, 461–463.—Describing the work of the above Committee since the detailed report of 1924, the test results on samples of oil distributed to laboratories are detailed; large samples of two oils, one known as Alpha oil, which was to be used as a secondary standard for viscosities at 100° F. S.U.; and a second known as Beta oil which was to serve the dual purpose at a 210° F. S.U. and 122° F. S.F. standard. After an agreed standardization the standard oils were released to the industry with values as follows: Alpha oil at 100° F. S.U. = 295·0 secs. ± 0·3%; Beta oil at 210° F.: S.U. = 148·5 secs. ± 0·3%; Beta oil at 122° F.: S.F. = 116·0 secs. ± 0·5%.

Eighteen major refiners in the United States have checked their instruments against the oils, and no measurable change in viscosity outside of the above tolerances has been reported. Two U.S. government bureaux and various consumer industries have used the oils for calibration standards.

Results obtained in 1930 by seventeen different laboratories on a sample of oil of unknown viscosity indicated that the A.S.T.M. method is capable of results within the tolerance of 1% prescribed.

Further tests in December 1933 on another oil designated A–33 revealed some divergencies between different laboratories, and two contributing sets of factors were established: (1) ambiguities in the description of the A.S.T.M. standard viscosity method; and (2) differences in equipment. The descriptive ambiguities have been largely rectified by re-writing the directions, and the experience will be transmitted to Committee D–2 of the A.S.T.M. The differences in equipment are being eliminated by more detailed specifications of the bath to be used in standardization work, and by establishing a set of new viscometer tubes to serve as primary and secondary standards.

B. C. A.

298. Laboratory Evaluation of Oil Stocks, Part I. W. L. Nelson. *Refiner*, 1935, **14**, 10–17.—The outstanding usefulness of evaluation analysis lies in the facility afforded for the study of the economics of plant operation without recourse to expensive plant scale experiments. The classification of crude oils according to gravity and gasoline content, viscosity index, viscosity gravity constant, and the key fraction methods developed by the Bureau of Mines is discussed, but comparison with oils of known base, involving most of the other methods mentioned, is considered the most reliable.

Distillation being the fundamental method for the separation of products, four assay methods, viz. A.S.T.M., Hempel, true boiling-point, and flash distillation, are discussed. The true boiling-point equipment of Peters and Baker and an equilibrium flash vaporiser are described in detail with drawings.

B. C. A.

299. Polymerisation of Liquid Hydrocarbons under the Action of Electric Discharges. G. J. Tarasov. *Compt. rend. Acad. Sci. U.S.S.R.*, 1934, **4**, 401–403.—Results are given showing the effect of varying the frequency (from 350 to 2000 cycles/sec.), the voltage (from 4 to 14 kv.), and the time of application of the current on the viscosity of the product formed by subjecting cracked kerosine to electric discharge.

The reaction is carried out under reduced pressure in an atmosphere of hydrogen in an apparatus similar to the Siemen's ozoniser. Under constant electrical conditions, the viscosity increased with the time of application of the voltage, the increase being more rapid after 6 hrs. If the frequency and time are kept constant, the viscosity increases with the electrical power. The optimum frequency is 500 cycles/sec.

C. C.

300. Chemistry of Voltol Oil Formation. A. D. Petrov and T. N. Bogoslovskaja. *Compt. rend. Acad. Sci. U.S.S.R.*, 1934, **4**, 394–397.—Straight-run and cracked kerosine and certain pure hydrocarbons (*e.g.*, octylene, hexadecene, cumene, etc.) were subjected to voltolisation (7500 V., frequency 1000 cycles/sec., time 6 hrs.). The yield, viscosity, specific gravity, and refractive index of the polymerised product

are recorded. The latter contains up to 60% of olefines, 23–28% of naphthenes and paraffins, and 15% of aromatics. These latter hydrocarbons give the highest viscosity, but the lowest viscosity-index, while olefines and paraffins give the lowest viscosity and highest viscosity-index.

The viscosity of the polymerised product from olefines and paraffins may be increased by adding naphthenes or aromatics before treatment, while the expenditure of electrical energy is less the greater is the content of naphthenes and aromatics.

C. C.

301. Structure of Liquids and the Mechanism of Viscosity. W. K. Lewis and L. Squires. *Refiner*, 1934, **13**, 448–454. (Annual Meeting A.P.I. 1934.)—The modern physical concept of the structure of the molecule, pointing as it does to the assumption of the existence of powerful attractive forces in the immediate neighbourhood of the molecular surface, leads to a clearer picture of the mechanism of liquefaction, and hence to a qualitative explanation of the influence of molecular weight and molecular structure on volatility and boiling-point, on liquid density and viscosity. It indicates the reasons for the differences in viscosity behaviour between liquids and gases, particularly the influences of temperature and pressure. It leads to the unexpected conclusion that for pure liquids the temperature coefficient of viscosity is determined predominantly by the viscosity itself, always resulting in extremely high temperature coefficients for viscous liquids.

The unduly high viscosity imparted to a solution by an emulsoidal solute of high molecular weight and chain-like structure, creates the possibility of attaining the high viscosities characteristic of pure compounds of extremely high molecular weight, combined with the low-temperature coefficients of viscosity inherent, in the case of pure substances, in those of low viscosity and low molecular weight. Mixtures of this type hold promise of developing extreme importance, particularly in the connection with hydrocarbon lubricants.

B. C. A.

302. Significance of Proknocks in Hydrocarbon Combustion. A. R. Ubbelohde and A. Egerton. *Nature*, 1935, **135**, 67.—While a large number of substances have a mild proknock effect, a special class have a pronounced effect in concentrations as low as 10^{-5} and 10^{-6} mol. fraction. The latter are so constituted that they can disrupt as follows: $C_2H_5O-\dot{}-OC_2H_5$, $ACO-\dot{}-OH$, whereas other peroxides which cannot split in this manner, *e.g.* $CH_2-C=CH_2$ (O–O), show no marked knocking effects.

Similarly, organic nitrates and nitrites which show this same fissure, *e.g.* $C_2H_5O-\dot{}-NO$, exhibit pronounced proknock properties, whilst nitro-compounds, such as nitrobenzene, which do not decompose in this manner, possess only a slight proknock effect.

These remarks bear relation to the observations of Hinshelwood, Williams, and Wolfenden (*Proc. Roy. Soc.*, 1934, **A. 147**, 48) on the combustion of hydrogen.

It would appear that this disruption of an already oxygenated molecule may be common to many explosion processes depending on chain branching.

It is interesting that the concentration required for proknock effect is smaller than 10^{-5}, since concentrations of antiknock of about the same order are required to prevent it.

D. L. S.

303. Study of Flame Temperatures in a Petrol Engine. B. Lloyd Evans and S. S. Watts. *Engineering*, 1935, **139**, 48–50.—This article deals with further work by the authors on temperature measurement using the reversal of the sodium line method as previously described. (Abstract No. 741, 1934.)

C. H. S.

304. Heats of Organic Reactions. I. Heat of Hydrogenation of Ethylene. G. B. Kistiakowsky, H. Romeyn, J. R. Ruhoff, H. A. Smith, and W. E. Vaughan, *J.A.C.S.*, 1935, **57**, 65–75.—The authors describe a special calorimeter, designed to measure the heats of catalytic hydrogenations in the gas phase at temperatures not above 150° C. With this they have determined the heat of hydrogenation of ethylene at 82° as $\Delta H = -32{,}824 \pm 50$ cals.

The paper also describes a sensitive method for estimating small amounts of ethylene in saturated hydrocarbon–hydrogen mixtures, and a still-head for fractionating columns designed to operate at constant pressure with partial return, while distilling low-boiling compounds.

W. E. J. B.

305. Synthesis of Benzine from Carbon Monoxide and Hydrogen at Atmospheric Pressure (in German). S. Tsunooka and K. Fujimura. *J.S.C.I., Japan*, 1934, **37**, 704B.—This article is a continuation of abstr. 1632 (1934) on this subject. Experiments were carried out with nitrogen, methane, or carbon dioxide of different degrees of dilutions, viz. 10%, 20%, and 40%, in the CO and H_2 mixtures CO : $H_2 \cong 1 : 2{\cdot}0$. Ni–Mn–ThO_2 catalysts were used.

It was found that gases containing less than 20% of nitrogen, methane, or carbon dioxide exerted no harmful influence on the synthesis, but dilution with 40% of nitrogen was harmful. The effects of carbon dioxide were more injurious to the synthetic reaction than nitrogen and methane. The benzine became gradually more volatile in proportion as the dilution of the initial gas increased. An apparatus is described for refining the gas so as to be free from sulphur compounds.

W. S. E. C.

306. Reaction of Sulphur with Benzene in the Presence of Aluminium Chloride. G. Dougherty and P. D. Hammond. *J.A.C.S.*, 1935, **57**, 117–118.—When benzene and sulphur are refluxed at 80° C., in the presence of aluminium chloride, diphenyl sulphide and thianthrene result. W. E. J. B.

307. Phase Equilibria in Hydrocarbon Systems. VI. Thermodynamic Properties of *n*-Pentane. B. H. Sage, W. N. Lacey, and J. G. Schaafsma. *Ind. Eng. Chem.*, 1935, **27**, 48.—The physical and thermal properties of pentane in the liquid and vapour states were measured over the temperature range 70–220° F. and at pressures up to 3000 lb. per sq. in.

The ratios of fugacity to pressure were calculated from the results. The values agree well with those for propane at the same reduced temperature, and with the generalised values given by Lewis and Kay (*Oil & Gas J.*, **32**, 45, 4) for the superheated gas and saturated regions.

The specific gravity of the condensed liquid is shown in a graph. The specific heat content and specific entropy were calculated by methods previously described (*Ind. Eng. Chem.*, 1934, **26**, 1218). The specific heat of the saturated gas was calculated using Young's data and the authors'. The experimental and calculated results are summarised in a temperature–entropy diagram. P. D.

308. Polymerisation of Olefines formed by the Action of Sulphuric Acid on Methyl-*iso*propylcarbinol. G. M. Kline and N. L. Drake. *Bur. Stand. J. Res.*, 1934, **13**, 705–712.—Methyl*iso*propylcarbinol was treated with 1½ moles of 75% H_2SO_4 at 80° C. for 20 min., and was found to produce two decenes: 3, 4, 5, 5-tetramethylhexene-2 and 3, 5, 5-trimethylheptene-2.

According to a theory proposed by Whitmore for the polymerisation of olefins (*Ind. Eng. Chem.*, 1934, **26**, 94), the formation of the above products could not be explained without the assumption of a complicated rearrangement.

Another theory is proposed based on the apparent activation of the olefin molecule causing it to behave as two fragments, which then add on to the double bond of another olefin molecule in the usual manner.

From a consideration of the relative calorie strength of the C–C and C–H bonds, it is predicted that the C–C bond would be preferentially broken during the addition of the activated olefin molecule to another olefin molecule, and this, in fact, is indicated by the authors' results.

This activation theory furnishes a simple mechanism for the di*iso*amylenes studied, and for the formation of the known di- and tri-*iso*butylenes from *iso*butylene.

D. L. S.

309. Synthesis of Condensed Polynuclear Hydrocarbons. R. O. Roblin, D. Davidson, and M. T. Bogert. *J.A.C.S.*, 1935, **57**, 151–159.—The preparation of certain hydrocarbons of the above type has been effected by treating certain phenylated alcohols and olefines with 85% or 90% sulphuric acid, which treatment results in cyclisation to yield, *e.g.* the corresponding tetralins, or indanes. W. E. J. B.

310. Determination of Ethane by Explosion with Oxygen or Air. J. R. Branham and M. Shepherd. *Bur. Stand. J. Res.*, 1934, **13**, 377–389.—A series of analyses of pure ethane has been made by explosion with: (1) Commercial O_2 containing 0·76% N_2 and inerts; (2) pure electrolytic O_2; (3) air, and the results compared one with

another and with results previously obtained by the slow combustion method (M. Shepherd and J. R. Branham, *Bur. Stand. J. Res.*, 1933, **11**, 783).

Large differences between the various groups of analyses were observed, no group giving results corresponding to the ideal equations.

These differences have been partly explained by errors found and measured. Thus in the experiments in which commercial O_2 and air were used, some N_2 was found to have been burnt. In all the groups of analyses CO was found to be present, and was estimated. Also evidence of the existence of a small amount of unburnt ethane was obtained, and a corresponding correction made.

The experiments with air were not quantitatively reproducible, and were very discouraging.

In general, the explosion method gave inaccurate results. It is shown that an analyst using the conventional procedure for so-called "exact" gas analysis would have estimated anything from 5 to 15% methane in this sample of ethane which was known to be pure. D. L. S.

311. Tabulated Analyses of Texas Crude Oils. G. Wade. *U.S. Bur. Mines, R.I.*, 3252, Dec. 1934.—The properties of all the Texas crude oils, with yields and analyses of products, which have been examined by the Bureau of Mines are presented in tabular form. The areas covered and their geological formations are: Texas Panhandle and W. Texas (Permian); North Texas (Pennsylvanian and older); E. Texas Basin and Central Texas (Cretaceous); and Texas Gulf Coast (Eocene and younger). In view of the inadequacy of the previous paraffin, intermediate and naphthene base classification, four intervening grades have been added, giving thus: paraffin, paraffin-intermediate, intermediate-paraffin, intermediate, intermediate-naphthene, naphthene-intermediate and naphthene. C. L. G.

312. C.F.R. Group Reports on 1934 Uniontown Tests. C. B. Veal. *Oil & Gas J.*, 22.11.34, **33** (27), 49.—Eight samples of branded fuels and nine experimental or non-branded fuels were used in these tests. The A.P.I. grav., A.S.T.M. distillation range, Reid V.P. of all these fuels and of the A-3 and C-8 secondary reference fuels are shown. The nature of each of the non-branded fuels is stated. In the car ratings the fuels were evaluated in terms of a matching blend of A-3 and C-8 or C-8 plus L.T.E., and if a second determination with different observers did not agree within 10% C-8, the results were further checked until agreement was obtained. Twenty-four cars, representative of the 1934 types of thirteen manufacturers, were used, and the engine characteristics are detailed. Three of each of the low-priced cars were included to give a suitable weighting to the road ratings. The basic procedure in conducting the tests was the road-test method adopted by the C.F.R. Committee in 1932. All fuels were run in all cars with spark adjusted according to manufacturers' setting. Adjustment of spark advance, or blending of fuel and subsequent extrapolation of the rating, was resorted to when fuels did not knock in certain cars under normal conditions. The fuels were tested by C.F.R. Motor method in nineteen laboratories and by C.F.R. Research method in seven laboratories preceding the road tests, and by C.F.R. motor method in twenty laboratories after completion of road tests. The mean of the two sets of motor method ratings was taken as the octane number of a fuel. The laboratory ratings, the road rating of each fuel in each car in terms of % C-8 reference fuel in the matching blend of C-8 in A-3, and the corresponding average octane rating for each fuel in all cars, are presented in tabular form. Out of a total of 653 group ratings, only forty-five were rejected, and the reasons for such rejections are given. The effect of variation in weather conditions on octane requirements of a car is illustrated by some of the rejected results. Blanks in the table are due to the use of one fuel of low octane rating and two cars of low octane requirement which precluded tests in many cases, and also to the fact that, where optional heads were provided, the ratings obtained with the various heads were regarded as made with one car. Maximum variations between average car ratings and C.F.R. motor method ratings on each fuel are + 2·7 and − 1·9 octane nos., and the algebraic average variation for all fuels is + 0·36 octane number. The spreads of the car ratings on some fuels are large, and illustrate the difficulty of developing a laboratory method which will give better correlation until they can be reduced. However, correlation between C.F.R. motor method and car ratings is within the experimental error of the technique employed, although it is admitted

that the reproducibility of both is not as good as could be desired. Active work on improvement of methods is in progress.

As regards cars, the tests indicate little change in engine-detonation characteristics since 1932. Average road ratings compared with laboratory tests in terms of octane numbers are: (1) Road rating *v.* Motor method, 1934, + 0·36, 1932, + 0·18; (2) Road rating *v.* Research method, 1934, − 3·12, 1932, − 3·55. Certain fuels are shown to be more sensitive to change in engine characteristics than others, and should not be used for determining octane requirements. The octane requirements of the test cars determined on blends of the reference fuels are shown. The effect of humidity must also be taken into account. Diagrams illustrate the wide variations between cars in respect of knock intensity-speed characteristics on test fuels as compared with reference fuel blends. Cars may be classified into five groups according to knock-speed characteristics. With a view to achieving better adaptation of fuels to engine and vice versa, an investigation of the causes of these variations is in progress. R. A. E.

313. A.S.T.M. and Road Test Results Differ beyond Experimental Error. K. G. Mackenzie. *Oil & Gas J.*, 22.11.34, **33** (27), 52.—Exception is taken to the statement in the previous paper that correlation between C.F.R. motor method and car ratings is within the limits of experimental error. It is pointed out that although the grand averages differ by only 0·36 octane number, eight of the seventeen fuels show deviations of 1 octane number or more, which is considered to be greater than experimental error in view of the method employed for checking results. Of these eight fuels, three are branded fuels, all of which show road ratings lower than motor method ratings. The remaining five are experimental fuels, all of which show road ratings higher than motor method ratings. This is extraordinary when it is realised that the experimental fuels cover a range of composition very similar to the branded fuels. It is also pointed out that the Californian straight run shows a deviation of 1 octane number, whereas it is generally believed that straight-run gasolines are practically immune to engine conditions, and should show the same relative standing with the straight-run reference fuels under all conditions. Since the benzole blend is the most highly derated by motor method as compared with road rating, the German motor fuel interests are not willing to accept the A.S.T.M. method without the privilege of adding 1/3 octane units to the reading for fuels containing considerable benzole. Other motor fuel interests feel that the deviations indicated cause an unwarranted handicap when marketing a gasoline intended to meet a certain standard of performance in cars on the road.

Attention is also directed to the fact that nine makes of cars tested, representing 76% of all 1934 cars registered during the first eight months of the year, gave higher ratings to test fuels than the C.F.R. motor method; whereas the other four makes, representing only 20% of this registration, gave lower ratings. Of this 20%, one make alone represented 17%. R. A. E.

314. Discussion of Laboratory and Road Test Correlation in Uniontown Runs. C. B. Wagner. *Oil & Gas J.*, 22.11.34, **33** (27), 53.—Dissatisfaction is expressed with the conclusion reached in Mr. Veal's report, purporting to show substantial agreement between C.F.R. motor method and road ratings. It is claimed that numerous determinations included ought to have been rejected according to the critical methods agreed on by the C.F.R. Committee when the tests were authorised. Alternatively, additional data should have been obtained. Road results on one fuel are considered incorrect, and also inadmissible, since satisfactory tests could not be made in more than nine cars owing to severe detonation, whereas the Committee previously agreed that results on at least 15 cars were necessary to rate a fuel. Exception is also taken to the method of recording other results. After examination of the original records, a revised list has been made. Variations in hill ratings amounting to 0·9 octane number occur with certain of the fuels as compared with those given in Mr. Veal's paper. The average variation for all fuels between car ratings and motor method ratings then amounts to + 0·58 octane number. It is also pointed out that there is a marked and unexplained difference in correlation between the branded and unbranded fuels tested. The branded fuels show on the average a road rating 0·8 octane number lower than motor method rating, whereas the unbranded fuels show on the average a road rating 1·1 octane number higher. R. A. E.

315. Inhibitors in Cracked Gasoline. III. Storage Stability as Related to Induction Period and Critical Oxidation Potential. C. G. Dryer, J. C. Morrell, G. Egloff, and C. D. Lowry. *Ind. Eng. Chem.*, 1935, **27**, 15.—The paper gives results of storage experiments carried out in order to determine the relationship between the potential of an inhibitor and its ability to stabilise gasoline in storage. Gasolines, some of them inhibited, were stored in vented glass bottles and examined periodically over a period of 20 months. A study of the data obtained shows that the initial stages of storage result in the formation of a small amount of gum and peroxides. Subsequently, the latter increase considerably, the alteration being accompanied by darkening in colour and loss of octane number. The formation of 10 mgrm. of gum indicates that the storage induction period is nearly over, and 15 mgrm. marks the beginning of rapid change. The storage life of different types of fuel as measured by the time required to form 10 mgrm. of gum cannot always be predicted from the initial induction period (bomb), but with any one material stored alone, or after the addition of inhibitors, the induction periods can be correlated with storage life. The increase of induction period due to an inhibitor is often more valuable in determining storage stability than the total induction period of the fuel. In many gasolines, an induction period of 300 minutes assures storage stability under laboratory conditions for more than one year. The critical oxidation potential of an inhibitor is related to its antioxidant power, but is not an exact index of its efficacy. In predicting storage stability, induction period appears to be the most reliable single test. A high result for copper dish test in some cases accompanies instability in storage, whilst increases in copper dish test and in peroxide number during the early part of a storage period denotes approaching deterioration in other respects, particularly gum formation. W. H. T.

316. Ageing of Mixtures of Transformer Oils. Goldo. *De Ingenieur*, 1934, No. 45, E. 173.—Recent continental studies contradict the views expressed by Förster and others that oil in transformers should be " topped up " only with oil similar in origin and degree of refining. Weiss and Salomon (*Conf. Int. des Grands Reseaux*, 1931, T1, p. 381) concluded from tests extending over three years that the addition of fresh oil of different origin does not accelerate sludging. This conclusion has been confirmed by the findings of a Commission which has collected data from German power-stations over a period of several years (*Mitt. der Studiengesell. für Höchstspannungsanlagen e.v., Elektrizitätsbewirtschaft*, 1934, p. 43). In a minority of cases an increase in sludging and acid formation did occur, but was traced to: (1) Inferior (resinous) nature of original oil; (2) presence of material derived from the transformer, and dissolved in the original oil; or (3) excessive degree of ageing of original oil. In normal cases topping up with fresh oil can accelerate sludging only when the old oil is already much deteriorated. The following limits are therefore suggested for the " aged " oil:

Saponification Value $\gtrless$ 1·0–1·4.

No ppt. on standing for 24 hours after mixing with 20 times its volume of normal benzine. P. G. H.

317. Properties of Diesel Fuel. N. Mayer. *Kali*, 1935, **29** (1), 6.—The desirable properties of Diesel fuel are discussed, and it is considered that they should particularly contain normal paraffin hydrocarbons. L. S.

Class 600. Refining and Refineries.

318. Refinery in Argentina. Anon. *Oil & Gas J.*, 31.1.35, **33** (37), 115.—Yacimientos Petroliferos Fiscales (Argentine Government Oilfields) have recently improved and enlarged their refinery at La Plata, and a complete range of products is now manufactured. The bulk of Argentine crude comes from the Comodoro Rivadavia area, where there are 1900 producing wells. Total Argentine production of crude is 38,000 brls. daily, of which Y.P.F. is reported to produce 14,000 brls. The refinery has a rated crude capacity of 19,000 brls. per day. The A.P.I. gravity of the crude treated ranges from 17° to 32°. The crude has to be dehydrated before topping, which is accomplished in both shell and pipe stills. A representative sample has the following properties: A.P.I. grav. 21°, fl.-pt. (P.M.) 95° F., sulphur 0·198%. Running to coke in shell stills at atm. pressure yields 6·5% gasoline, 10% kerosine, 42·5% gas oil, 9·5% light lub. oils, 17·5% viscous lub. oils. Cracking is therefore necessary to

produce substantial yields of gasoline, and the refinery has four Cross units with a capacity of 7000 brls. per day using gas oil from primary distillation as charging stock.

A complete gasoline recovery unit with equipment for production of liquefied gases is provided. A vacuum distillation unit is used for the manufacture of lubricating oils from overhead cuts from primary distillation. The oils are subsequently treated with SO_2 in an Edeleanu plant, the heavy grades are dewaxed by centrifuge, and commercial grades of wax are obtained from the lighter oils by filtration, cooling, and pressing. The plant residues are used for manufacture of asphalts and road oils. Special products, such as insecticides, emulsified oils, tractor oils, turpentine substitutes, alcohols, and petroleum coke, are also manufactured. R. A. E.

319. New Refinery in England. Anon. *Oil & Gas J.*, 17.1.35, **33** (35), 36.—Lobitos Oilfields Ltd. have **recently completed a refinery at** Ellesmere Port, Cheshire, with a capacity of 2500 brl. daily, producing from Peruvian crude light products, distillates, lubricating oils, cylinder stocks, and asphalt. The process consists of a two-stage topping unit, taking off gasoline, kerosine, and white spirit by atmospheric distillation, followed by vacuum distillation. A Stratford oil circulation fractionating unit is used for the topping. The radiant heater is of unique design, consisting of a corrugated firing tube 4 ft. in diameter and 12 ft. long, on the outside of which is a second tube into which oil circulation nozzles are placed at an angle of 90° to the corrugated surface and through which the circulating oil flows at 90–100 ft. per second. Very high average transfer rates are obtained (85,000 B.Th.U. per sq. ft. of heating surface). The crude oil travels via heat exchangers and condensers to a pressure settler, and thence to the tubular convection section, where it is heated by the flue gases, and passes at 320–383° F. to the gasoline tower. The hot topped crude from the base of this tower passes to a further vaporiser tower, where it is heated by contact with the circulating oil from the heaters. The vapours pass to a third tower, and the residuum to the vacuum unit. In the vacuum pipe still the oil is heated to approx. 775° F., and passed to the fractionating column, where light spindle oil is taken off as top distillate, heavy spindle, light and heavy machine, and cylinder stocks being taken off as side streams with bitumen as the residue. Full temperature volume and pressure control is available throughout the unit. C. L. G.

320. Efficiency of Petroleum Fractionating Columns. V. W. Garton and R. L. Huntington. *Refiner*, 1935, **14**, 18–20.—In order to determine the efficiency of commercial bubble towers, it is necessary to carry out accurate analyses in laboratory apparatus. For the separation of crude oil and heavier petroleum fractions an apparatus, consisting essentially of an electrically-heated distilling flask with column, 57 in. × 1¼ in. I.D., packed with ¼-in. lengths of ¼-in. thin-walled glass tubing, the whole being fabricated in Pyrex. The column is heated by means of a spirally wound nichrome wire, and is provided with a jacket. Two vacuum pumps enable the continuous maintenance of high vacuum on the system.

Known mixtures of benzene and toluene were distilled at different rates in order to compute the number of theoretical trays in the column, and the results were analysed graphically according to the method of McCabe and Thiele. These indicate that the time element is of importance. B. C. A.

321. Pressure Drop through Dry Packed Towers. S. Uchida and S. Fujita. *J.S.C.I., Japan*, 1934, **11**, 724B.—A theoretical discussion of the pressure drop through dry packed towers leads to the equation :

$$\frac{\Delta p}{\rho l} = C\left(\frac{u^2}{2gd}\right)^p \left(\frac{du\rho}{\mu}\right)^q \left(\frac{D}{d}\right)^r$$

$\frac{\Delta p}{l}$ = pressure drop per unit length of tower.

D = inside diameter of tower.

d = diameter of packing or its equivalent.

u = mean velocity of fluid based on empty tower.

ρ = density of fluid.

μ = viscosity of fluid.

p, q, r, C = constants.

The method of evaluating the constants by means of experiment is described.

Experiments were carried out on lead shot packing of three sizes (0·184, 0·299, and 0·441 cm.) in three sizes of tower. For values of $\left(\frac{du\rho}{\mu}\right)$ below 50, q was found to be − 0·86, whilst for values between 50 and 300, which was the upper limit in the experiments, q equals − 0·47, $p = 1·05$ and $v = 0$ at all values of Re.

Raschig rings of three diameters (0·5, 0·7, and 1·0 cm.) were also tested. r was again found to be equal to 0, and p to be 0·94 over a range of $(du\rho/\mu)$ 10–1000. q equals − 0·64 for the range $(du\rho/\mu)$ 10–30, − 0·38 for 30–100, and − 0·16 from 100 to 1000.

P. D.

322. Refining Pressure Distillate with Zinc Chloride. A. Lachman, *World Petr.*, Oct. 1934, **5** (10), 384.—Since the author's first description of his process several additional plants have been built and put into operation. The location and capacity of these plants and of others under construction are given. The treater may be operated without intermediate condensation of raw pressure distillate, or on re-vaporised pressure distillate accumulated from one or more plants. The advantages and disadvantages of the two methods are outlined. Where there is a large amount of H_2S in the cracked vapours, it is economical to stabilise before treating, but where the H_2S content is relatively low, stabilisation after treatment is possible. Mechanical losses, due to leaks and improper condensation, should not exceed 0·5%. Chemical losses, primarily due to polymerisation, vary according to the material under treatment; one plant records losses of 0·28%, whereas another, operating on vapour-phase cracked distillate, records ⅛%. In the latter plant losses of 7·5% were incurred when treating with acid, and the octane rating of the treated gasoline was 72, as compared with 74 when treating with zinc chloride. The colour stability and gum content of the treated gasoline seem to be a function of the treating time, and may be made to conform to very stringent specification with an increase in polymer formation of usually less than 1%. Sulphur and mercaptan contents of the gasoline are reduced by the treatment, but considerable reductions may be accompanied by large increases in chemical consumption. To remove all mercaptans it is usually better to treat by some other method, such as plumbite. This can be achieved without loss of colour stability, such as occurs when acid refining is employed. Zinc chloride consumption ranges from 0·3 to more than 1 lb./brl. of gasoline treated in the plants now operating, depending on the sulphur content reduction.

R. A. E.

323. Preparation of Lubricating Oil, Paraffin, and Asphalt from Distillation Residues from German Crude Petroleum. —. Widdecke. *Angew. Chem.*, 1935, **48**, 110–112.—The usual selective solvents do not give a satisfactory separation of paraffin and asphalt. A process is described in which the distillation residue is dissolved in amyl alcohol at 40–60° C. and the mixture cooled to 0° C. The procedure is repeated on the separated paraffin and asphalt. From the combined extracts soft paraffin is obtained by cooling to − 10° C., while lubricating oil is recovered by distilling off the solvent. The mixture of paraffin and asphalt is dissolved in aqueous amyl alcohol at 75° C. and cooled to 40° C. Hard paraffin is separated, and the asphalt recovered from the alcohol solution.

C. C.

324. New Natural Gasoline Plant. Anon. *Oil & Gas J.*, 17.1.35, **33** (35), 11.—The first natural gasoline plant in the Gulf Coast district of Louisiana has been in operation for the past 6 months, in the Iowa field, processing 12 million cu. ft. of gas daily. The plant is of conventional type, the greater portion of the gas being taken under 50 lb. pressure from the field separator, and having a gasoline content of 0·7/0·8 gal. per 1000 cu. ft. The absorbers have a capacity of 400 gal. of mineral seal oil per minute, and the gas is stripped to a content of 0·007 gal. of gasoline per 1000 cu. ft. with a calorific value of 1080 B.Th.U. per cu. ft. Reducing the pressure in the joint absorber from 50 to 40 lb. produces a gas of gasoline content 14 gal. per 1000 cu. ft., which is used as fuel under boilers in the steam-generating plant. The bottoms are run through heat exchangers and preheaters to the still (a combination still and dephlegmator operating at 30 lb.), where the rich oil is stripped of its gasoline fractions, which are then condensed and stabilised. The vapour product of the finished product is thus reduced from 30 lb. to 18 lb., with all the propane and half the butane taken off and used as fuel.

C. L. G.

325. Use of Propane as a Refrigerant in Natural Gasoline Recovery. Anon. *Nat. Pet. News*, 2.1.35, **27** (1), 20.—Refrigeration by the direct expansion of liquid propane has recently been applied to the recovery of natural gasoline. The casing-head gas is compressed to 300 lb., cooled, and passed to a tower of the direct rectification type. The condensate is passed through an external re-boiler, heated by steam coils, and pumped to a stabiliser tower. The stripped gas is cooled to 70° F. and passed through the propane cooler. This is of the heat-exchanger type, the expanded propane being passed through the annular space around the inner tube containing the gas. Here the gas is cooled to 40–45° F. condensing propane. The expanded propane is released to the main gas outlet to mingle with the other outgoing gases. The yield is 13 gal. of 26–70 gasoline per M. cu. ft. H. G.

326. Recovery of Gasoline from Natural Gas in U.S.A.—Anon. *De Ingenieur*, 1934, No. 44, M. 72.—A short historical and statistical account of the American natural gas industry. Methods of separation of gasoline and the applications of the scrubbed gas are described. P. G. H.

327. Unexpected Emulsions. K. S. Valentine and G. MacLean. *Refiner*, 1935, **14**, 32–35.—A parallel is drawn between refinery treating processes and emulsion manufacture proper. Causes of the formation and stabilisation of emulsions are given, and methods of heating them are suggested.

The methods include heat, change of interfacial tension, electrical methods, selective wetting by running over laths or other material previously wetted with the internal phase of the emulsion to be broken, the use of small portions of acid or alkali, chemical change, and freezing.

The value of preventative investigation is emphasised. B. C. A.

328. California Practice in Production of Liquid Gas. H. N. Wade. *Refiner*, 1935, **14**, 3–6.—The available sources of liquid propane and butanes are, in the order of their present importance: natural gasoline plants, refinery vapour recovery systems, and cracking unit pressure-distillate stabilisers. Typical operating methods based on the various conditions and requirements are discussed. Liquid gases originating from sulphurous stocks require treatment to prevent corrosion of the utilisation equipment, and dehydration is desirable. For complete dehydration silica gel is most commonly used. B. C. A.

329. Protective Value of Nickel and Chromium Plating on Steel. W. Blum, P. W. C. Strausser, and A. Brenner. *Bur. Stand. J. Res.*, 1934, **13**, 331–355.—Exposure tests of plated steel were carried out in rural, suburban, industrial, and marine locations.

It was found that the total thickness of the nickel (or Cu and Ni) coatings is the most important factor in their protective value, whether or not chromium is also applied. An intermediate layer of Cu in Ni deposits is nearly always detrimental in thin layers, but is not objectionable in thick deposits, especially if chromium is applied.

Plating chromium directly on to steel gives poor protective action. The customary thin chromium coatings (0·00002 in.) increased the resistance to tarnish, but not to corrosion. D. L. S.

330. Accelerated Tests of Nickel and Chromium Plating on Steel. P. W. C. Strausser, A. Brenner, and W. Blum. *Bur. Stand. J. Res.*, 1934, **13**, 519–526.—Plated-steel specimens similar to those used for the atmospheric exposure tests were subjected to accelerated corrosion tests.

In one of these the plates were placed at an angle of 45° to the horizontal and sprayed with 20% NaCl solution at 35° C. In another the specimens were immersed intermittently in 20% NaCl solution.

The time required for the first appearance of slight rust was not consistent, and bore no direct relation to the protective value of the coatings. If, however, the number of rust spots was recorded after a definite period, *e.g.* 100 hrs., the results were approximately parallel to those of atmospheric exposure.

Since the protective value of a metallic coating of this type depends on its freedom from porosity, this property was determined by the ferroxyl test using a reagent containing 60 gm./litre NaCl and 0·5 gm./litre potassium ferricyanide. D. L. S.

331. Salvage of Refinery Wastes. L. C. Trescott. *Refiner*, 1935, **14**, 21–26.—A suggestive article on the salvaging and utilisation of refinery wastes including constructional material and by-products of refining. B. C. A.

332. Patents on Refinery Plant.—British Thomson-Houston Co. E.P. 421,003, 12.12.34. Process for providing articles with an adherent coating of an oxide as protection from corrosion, etc. Volatilisable compounds of organic or inorganic nature which can be decomposed by heat are introduced into the flame of a blow lamp. The flame decomposes the compound and deposits the oxide as a coating on the article.

Enfield Cable Works. E.P. 421,324, 18.12.34. A method of localising leaks in pipe-lines used for gases or liquids. Another gas or liquid differing by an easily distinguishable property is injected into the flowing stream, and forms a column capable of travelling in the pipe-line. Subsequent analysis of pipe-line samples taken from suitable points enables the position of the leak to be located.

F. Hejduk. E.P. 421,376, 19.12.34. A volumetric liquid meter with a device for correcting errors due to thermal dilatation.

J. W. Hartley. E.P. 421,479, 21.12.34. A rotatable scraper device for removing sludge from the sides of tanks. The scrapers are driven from a rigid rotating ring mounted on the outer circular wall of the tank.

W. C. Bailey. U.S.P. 1,983,832, 11.12.34. Apparatus for separating oil from oil-water emulsions. The emulsion is passed through a heat exchanger, then through a steam-heater, and finally to a cooled settling chamber.

P. Mather and D. J. Bergman. U.S.P. 1,984,686, 18.12.34. Apparatus for stabilising cracked vapours. W. H. T.

333. Patents on Cracking.—Carburetted Gas Inc. E.P. 420,713, 6.12.34. Oil is heated under pressure, passed to a zone of higher temperature, and the pressure then released so that the oil is immediately vaporised and converted into a fixed non-condensible hydrocarbon gas. W. H. T.

Standard Oil Dev. Co. Dutch P. 60,556, 16.3.32. Cracking of oil by passing its vapour through a fractionating zone under pressure. The residual condensate is collected in an accumulator, where fresh oil is added and the blend re-cycled. The pressure in the accumulator is higher than in the fractionating zone. P. C. K.

Brassert-Tidewater Dev. Co. E.P. 421,408, 13.12.34. Coking hydrocarbon oil by passing it at elevated temperature into an externally heated coking chamber the temperature of which is increased by passing into it a re-cycled condensate. The latter is derived from the volatile products of the process, and in being re-cycled has been heated to a temperature above that of the charge stock passing into the coking chamber.

B. Foss. U.S.P. 1,982,863, 4.12.34. High-temperature destructive distillation of crude oil in the presence of dissociated water.

J. Cutter. U.S.P. 1,983,659, 11.12.34. A method and apparatus for removing residue oils from plant which tends to become choked with coke. Means are also provided for the removal and condensation of vapours given off by the residue on being removed from the plant.

E. C. Herthel. U.S.P. 1,983,664, 11.12.34. A "tube and tank" process for cracking heavy gas oil or wax distillate. The supply of cracking stock and the withdrawal of tar-laden oil are regulated to prevent saturation of the oil in the plant with pitchy constituents.

C. H. Angell. U.S.P. 1,983,688, 11.12.34. A process for the simultaneous conversion of separate charging stocks of different characteristics, accompanied by reduction of the residual conversion products to dry carbonaceous material.

G. Egloff. U.S.P. 1,983,693, 11.12.34. Straight-run gasoline is cracked to form olefines which are polymerised by the action of an acid of phosphorus to form an anti-knock fuel.

M. G. Paulus. U.S.P. 1,983,919, 11.12.34. Cracking plant fitted with a flash chamber with a conical bottom. The conical section houses a propeller which keeps the cracked residue in motion and thus prevents accumulation of coke.

M. L. Chappell. U.S.P. 1,984,519, 18.12.34. Oil is cracked in the liquid phase, and the resulting vapours are passed to a reaction zone together with a gas containing 5 to 18% of oxygen in sufficient quantity to reduce the hydrogen content of the oil to approx. 14·3% by weight.

H. L. Doherty, U.S.P. 1,984,522, 18.12.34. Oil is heated and passed at high velocity through a succession of enlarged chambers, the later chambers being heated only sufficiently to maintain the oil at conversion temperatures.

M. B. Cooke and H. C. Schutt. U.S.P. 1,984,569. 18.12.34. Vapour-phase cracking in which the cracked vapours are mixed with a heat-carrier gas in order to bring about a pyrolytic decomposition. The latter is controlled by a spray of oil which stops the reaction and thus prevents over-cracking.

K. Swartwood. U.S.P. 1,984,662, 18.12.34. A combined liquid- and vapour-phase process, both phases employing the same reaction chamber.

W. S. Gullette. U.S.P. 1,985,029, 18.12.34. A raw stock and a re-cycle oil are cracked separately, both in the vapour phase. The resulting vapours are scrubbed and fractionated separately and the condensates blended.

W. F. Moore. U.S.P. 1,985,053, 18.12.34. Oil is cracked in the liquid phase and the reflux condensate vaporised and cracked in the vapour phase. The unvaporised reflux condensate is re-cycled to the liquid phase section.

J. K. Roberts. U.S.P. 1,985,214, 18.12.34. A condensate and a heavy oil are cracked separately, the latter under relatively mild conditions. The vapours from both sections are combined and fractionated, the reflux condensate forming the stock for one of the cracking stages.

E. W. Beardsley. U.S.P. 1,985,233, 25.12.34. A cracking stock is divided into a number of fractions and the lightest mixed with a heated heat carrier gas. The other vapour fractions are then successively added to the mixture, so that the heaviest is subjected to conversion conditions for the least period of time.

E. W. Beardsley. U.S.P. 1,985,234, 25.12.34. A gas-tight valve for use in processes similar to the above.

D. G. Brandt. U.S.P. 1,985,440, 25.12.34. A liquid phase process in which the cracked residue is partially vaporised by passing through it a preheated gas. The vapours are condensed and the condensate is re-cycled.

W. B. Mapes. U.S.P. 1,985,680, 25.12.34. A design of heat exchanger suitable for incorporation in vapour-phase systems. W. H. T.

334. Patents on Hydrogenation. Standard Oil Dev. Co. D.R.P., 605,677, 24.8.30. Hydrogenation of shale or coal oils in the presence of catalysts. The products are treated with alkali and then with solvents which dissolve the aromatic and paraffinic hydrocarbons. L. S.

G. Natta. E.P. 420,652, 5.12.34. Preparation of hydrogen from water-gas by combining carbon monoxide with steam to form carbon dioxide and hydrogen in the presence of a catalyst (zinc carbonate). W. H. T.

I. G. Farbenind A.-G. Dutch P. 55,379, 27.1.31. The heated parts of hydrogenation equipment are constructed of an alloy containing Cr or Mo and practically no Ni. P. C. K.

C. Krauch. U.S.P. 1,983,234, 4.12.34. Hydrogenation of carbonaceous materials at 300–100° C. and 20 atm. press., using as a catalyst, a sulphide of a metal of the sixth group of the periodic system.

M. Pier and E. Donath. U.S.P. 1,983,241, 4.12.34. For the production of lubricants, oil is preheated and vaporised in admixture with hydrogen in a vaporising zone. Vapours and liquid are separated and the liquid is hydrogenated at 300–420° C. and 20 atm. pressure in the presence of a catalyst selected from the fifth to seventh groups of the periodic system and compounds of alkali metals and alkaline-earth metals.

M. Pier and W. Kroenig. U.S.P. 1,984,596, 18.12.34. Hydrogenation of carbonaceous material at 300–600° C. with a high partial pressure of hydrogen without substantial conversion into benzine and middle oil. The latter are removed and the residue is destructively hydrogenated at 300–500° C. in the liquid phase, the ratio between hydrogen and carbonaceous material being lower than in the first stage. The low-boiling hydrocarbons thus formed are hydrogenated further in the vapour phase. W. H. T.

335. Patents on Crude Oil. M. de Groote. U.S.P. 1,984,633, 18.12.34. Water-in-oil emulsions are broken by the action of a mixture of oxidised castor oil with salts of petroleum sulphonic acids.

C. R. Wagner. U.S.P. 1,984,903, 18.12.34. A method of desalting crude oil produced from wells which have been acid-treated in order to increase their flow. The oil is mixed with water without forming a permanent emulsion, the mixture is allowed to stratify, and oil is decanted from the aqueous layer.

C. H. M. Roberts. U.S.P. 1,985,692, 25.12.34. Breaking oil-in-water emulsions by the action of a condensation product of a heterocyclic compound and a non-sulphoreactive hydrocarbon body.

M. de Groote. U.S.P. 1,985,720, 25.12.34. A reagent for breaking emulsions which consists of a substituted aromatic sulphonic acid body of the type R.T.Z. SO_3R'. R is a naphthalene residue, T is a hydrogen atom, Z is the hydrogen ion equivalent of the sulphonic acid, SO_3 is the conventional sulphonic acid residue, and R′ is a *cyclo*-olefinic residue derived from Blau-gas tar middle distillate. W. H. T.

336. Patents on Gas. Siemens Schuckert Werke. D.R.P. 562,891, 1.4.30. The stages of a multi-stage electrical purification are supplied by currents of different frequencies, the first using a continuous current of lower frequency than the following stages.

P. Baumann. D.R.P. 606,011, 1.6.30. Production of aromatic hydrocarbons from acetylene, natural gas, etc. by high-temperature catalytic conversion. Gases lower in hydrocarbon content are then treated in the electric arc in the usual manner.

Ruhrgas A.-G. D.R.P. 600,144, 25.3.32. Desulphurisation of gas by passage through a rotary reaction chamber containing an arrangement of projections and packing material. The latter is continuously passed through the chamber.

Metall Ges. D.R.P. 604,294, 17.2.33. Removal of carbon dioxide and hydrogen sulphide by high-pressure solution in water.

Ruhrchemie A.-G. D.R.P. 605,640, 18.12.30. Pyrolysis of methane, etc., at a pressure of 0·1 atm. .

A. J. Peski. D.R.P. 605,737, 17.1.28. Production of unsaturated hydrocarbons by heating low-boiling aliphatic saturated hydrocarbons at atm. or moderately elevated pressure in the presence of S, Sb, As, Se, or Te as catalysts.

Bat. Pet. Mij. D.R.P. 606,343, 24.2.33. Removal of acetylene from gas mixtures by counter-current treatment with poly-glycols, their ethers, esters, or ethyl esters. L. S.

Bat. Pet. Mij. Dutch P. 59,865, 15.1.32. Pyrolysis of hydrocarbon gases in a chamber filled with fire-brick and heated by the combustion of gas at the top of the chamber. P. C. K.

337. Patents on Motor Spirit. Soc. Anon. Carburanti Italia. E.P. 420,600, 26.11.34. A motor fuel comprising 40–60 parts of ethyl alcohol, 60–40 parts of light oils of asphalt or of tar, and 2 parts of naphthalene. The mixture is distilled and the vapour heated at 350–500° C. W. H. T.

Fuel Dev. Corpn. Dutch P. 59,105, 11.11.31. A non-knocking motor fuel is obtained by the addition of small quantities of aniline, ethyl alcohol, and butyl alcohol to gasoline.

Universal Oil Prods. Dutch P. 65,396, 23.5.33. Refining of light oil with hydrogen chloride in the presence of metals at elevated temperatures and pressures, without vaporisation of the oil during the reaction. P. C. K.

Houdry Process Corpn. E.P. 421,650, 28.12.34. Production of motor fuel from cracked hydrocarbon vapours. After the removal of fixed and incondensible gases, the vapours are contacted with a catalyst (clay + metallic oxide = 98 : 2) at 400–700° F. in order to effect refining and polymerisation.

J. D. Fields. U.S.P. 1,983,220, 4.12.34. Catalytic treatment of motor spirit for sufficient time to effect coagulation of the impurities. Some of the latter are precipitated on the alkali metal of the catalyst and some are held in suspension in the distillates in a flocculent state. Small quantities of a solution of halogen salts are then added to the distillates, whereby the coagulated impurities are dissolved and converted into a heavy oil which is separated from the distillates. W. H. T.

338. Patents on Kerosine. S. N. Sherwood. E.P. 421,477, 21.12.34. A brooder oil lamp in which the fuel container is provided with a central and vertical air passage, and above the top of it with two horizontal plates, on the upper one of which open-ended chimneys enclosing the burners rest. Currents of air are directed by the plates into the lower ends of the chimneys, but the plates also protect the container against over-heating.

B. Nier. E.P. 421,478, 21.12.34. A wick burner for hurricane lanterns in which the wick sheath is constructed of copper in order to dissipate the heat evolved at the top of the wick sheath.

S. E. Campbell. U.S.P. 1,985,717, 25.12.34. Decolorising distillates by counter-current treatment with sulphuric acid in a series of chambers containing contact material. W. H. T.

339. Patents on Lubricating Oil. E. Kramer. D.R.P. 605,940, 27.10.32. Graphite for the production of graphite grease is reduced to colloidal dimensions by means of a mill containing balls of not more than 3–5 mm. dia. The material is reduced to a paste of sufficient fluidity not to adhere to the balls.

E. Kramer. D.R.P. 606,040, 24.8.32. A graphite grease paste is produced by mixing fat with graphite while warm, using a drum with rotating brushes for proper distribution of the graphite. L. S.

W. C. Thorpe. E.P. 420,682, 6.12.34. A lubricant comprising an emulsion of degras, freed from fatty acids, kerosine water, turpentine, and ammonia with graphite in suspension.

Standard Oil Dev. Co. E.P. 402,262, 30.11.33, amended 7.11.34. An improved lubricating oil containing 0·5–5·5% of an ester (b. pt. 302° F.) other than that of a polymeric carbohydrate and butyl lactate. The ester may be produced from an acid derived by the oxidation of paraffin wax with air.

J. F. Wait. E.P. 420,909, 3.12.34. Treatment of oil by passing its vapour through a plurality of contact zones each containing a flowing stream of a molten anhydrous reagent (*e.g.* sodium hydroxide) at 250–500° C. The composition of the reagent may vary from zone to zone, and may also contain free metal.

J. Y. Johnson. E.P. 421,118, 10.12.34. Production of hydrocarbons of high molecular weight from *iso*-butylene. The latter in the liquid state is subjected to the action of gaseous or solid volatile halides of the second, fifth, sixth and eighth groups of the periodic system at above 10° C.

M. B. Miller & Co. E.P. 421,123, 10.12.34. Solvent extraction of mineral oils using a paraffinic and a naphthenic solvent. The former may consist of ethane, propane, butane, petroleum ether, gasoline, etc., whilst the latter is a wood tar acid such as guaiacol, creosol, or beechwood creosote.

"Yacco" S.A.F. E.P. 421,226, 17.12.34. Apparatus for the experimental oxidation of lubricating oil with air, the extent of alteration of the oil being determined by normal tests such as viscosity, colour, etc. The oil is subjected to mechanical shearing stresses between two coaxial truncated conical members which are adjustable relative to each other. Air or gas is fed between the conical surfaces, which are provided with channels.

F. J. F. Karthaus. U.S.P. 1,982,992, 4.12.34. Purification of used lubricating oil by adding an emulsion, heating the mixture, and removing the precipitated impurities. The emulsion is formed from a solution of an anhydrous soap in a vegetable oil non-miscible with the lubricating oil. The solution is emulsified with distilled water and, when ready, is made slightly alkaline.

J. T. Rutherford. U.S.P. 1,983,678, 11.12.34. Separation of entrained oil from acid sludge by heating the latter to cause rapid separation. The sludge is then cooled while settling to a temperature below that at which ebullition and polymerisation take place.

J. Robinson. U.S.P. 1,984,432, 18.12.34. A method for neutralising oil containing emulsion-forming oil-soluble organic acids. A large volume of dilute aqueous alkaline solution is added to the oil with agitation under conditions favourable to the formation of oil-in-water emulsions. The latter are subsequently resolved into oil and water phases.

G. B. Finch. U.S.P. 1,985,083, 18.12.34. Distillation apparatus for the recovery of sed lubricating oil. W. H. T.

340. Patents on Fuel Oil. E. W. Brocklebank. E.P. 421,556, 24.12.34. Production of coke and a distillate from coal–oil mixtures using an externally heated inclined rotating cylindrical retort. W. H. T.

341. Patents on Asphalt. E. Rouault. E.P. 421,113, 6.12.34. More than 2% of a phenolic flux is added to asphaltic bitumens to produce liquid road asphalts which may be applied cold (*i.e.* below 50° C.). W. H. T.

Colas Flintkote Ltd. Dutch P. 57,440, 25.6.31. Dispersions of bituminous materials are obtained by mixture with a finely-divided water-soluble compound in

such a way that water absorption into the disperse from the continuous phase will occur. P. C. K.

E. Rouault. E.P. 421,269, 6.12.34. Bitumen emulsions containing water, bitumen, and coal-tar pitch. An alkaline material capable of reacting with the phenolic constituents is also added.

E. B. McConnel. U.S.P. 1,982,920, 4.12.34. Preparation of oxidised asphalt by atomising petroleum residue in a whirling, non-stratifying form in counter-current flow to the air. W. H. T.

342. Patents on Special Products. I. G. Farbenind. A.-G. D.R.P. 603,742, 23.9.30. Simultaneous production of carbon black and acetylene by electric-arc treatment of hydrocarbons. The product is reduced in temperature, whereby the carbon black is precipitated and the carbon-free gas is then fully cooled.

I. G. Farbenind. A.-G. D.R.P. 604,640, 21.5.33. Production of vinyl ester by conversion of acetylene with carbonic acids in the presence of mercury compounds.

Chem. Fabrik Pott & Co. D.R.P. 604,641, 7.10.32. Production of sulphonates from acid-tars by neutralisation followed by salting out with 8–15% sodium chloride solution. L. S.

L. A. Levy. E.P. 420,520, 26.11.34. Chlorination of naphthalene by passing chlorine through the molten material in the presence of a halogen carrying catalyst (anhydrous ferric chloride) until a product containing 40–44% by weight of chlorine is obtained. The product is distilled and the distillate chlorinated further.

Sharples Solvents Corpn. E.P. 420,636, 5.12.34. Production of alkyl derivatives of phenolic compounds in which an acid liquor, produced by treatment of an olefine with acid, is treated with a phenolic compound, and the resulting material refluxed to produce the desired condensation product. W. H. T.

Bat. Pet. Mij. Dutch P. 66,669, 14.9.33. Asymmetric ethers are synthesised from alkenes and methyl alcohol by heating with a catalyst at below 95° C. P. C. K.

W. A. Gruse. U.S.P. 1,985,860, 25.12.34. A sealing liquid for waterless gas holders. It consists of a pressure still tar distillate obtained by fractional distillation of the residual tar from cracking processes. It has a specific gravity greater than that of water and a viscosity of the order of that of medium and heavy engine lubricating oils. W. H. T.

343. Patents on Coal. J. Y. Johnson. E.P. 421,356, 19.12.34. A process for the gasification of fine-grained solid fuels in which a gasification agent is blown through an incandescent layer of the fuel together with a combustible gas. The speed of the gas is such that a movement similar to boiling is established in the fuel.

Gas Light & Coke Co. E.P. 421,643, 21.12.34. Removal of hydrogen sulphide from aqueous liquids such as the solutions used for scrubbing coal gas. A stream of oxygen is passed through a mass of porous material on which a catalyst is supported, and the liquid is caused to flow simultaneously over the porous mass. W. H. T.

Class 700. Utilisation.

344. High-Speed C.I. Engines for Motor-Vehicles. N. Mitchell. *J.S.A.E.*, 1935, **36**, 17–22.—The use of Diesel engines for commercial vehicles is increasing rapidly in Great Britain, and this article reviews the experience of the London Passenger Transport Board with the A.E.C. Ricardo engine and another concern which operates a large fleet of Leyland-engined vehicles.

Taking the total cost per mile of a gasoline-engine bus as 100, the equivalent Diesel-engined vehicle works out at 83·2, the very much lower fuel cost of the latter more than offsetting the increase in cost of maintenance and tax. The troubles at first experienced with smoky exhaust, failure of big ends, etc., have now almost entirely been overcome, and it is very possible that the L.P.T.B. will purchase no more gasoline engines for passenger bus service.

The article contains various tables showing details of running costs of Diesel as compared with gasoline engines. C. H. S.

345. Air Swirl in Oil Engines. J. F. Alcock. *Aut. Eng.*, 1935, **25**, 49–54.—This article deals very fully with the whole problem of controlled air swirl which is necessary for the successful operation of a Diesel engine, as distinct from the indiscriminate turbulence which is satisfactory in a petrol engine, owing to the fact that in the latter case

the turbulence has only to scatter the flame nuclei, whilst in the case of the Diesel engine, the fuel droplets and the air can be successfully brought together only by ordered movement, because if the small particles which ignite are allowed to remain near their heavier neighbours, the latter will be blanketed by burnt gases, hence the necessity for sweeping them right away from the larger particles. Three methods of swirl production are dealt with, viz.: induction swirl, compression swirl, and combustion swirl, and the merits of different types of engines utilising high, low, and medium-speed swirl are enumerated. The chief feature of high-speed swirl as used in most spherical combustion-chamber designs is the ability to burn a high percentage of the total air charge, although ease of starting suffers due to the cooling effect of the small throat on the gases as they are compressed into the spherical chambers. The low-swirl engines suffer from mechanical drawbacks such as multiple injection orifices and high injection pressures, but have the great advantage of easy starting from cold without electric heaters. Quantitative examinations of the various swirl problems in two-stroke, sleeve-valve, and poppet-valve engines are made, and the effects of swirl on the fuel spray are fully dealt with.

In summarising the results, it is suggested that the effect of swirl appears to be that of winnowing the full spray, removing the fine spray and burnt gas, and giving the heavier particles access to fresh unburnt air.

For the one combustion system thoroughly investigated, there is an optimum swirl ratio which is practically independent of engine speed, size, and load, and which is characteristic of that combustion system. There is evidence that the same principle applies to other high-swirl systems, and may be generally applicable. Both under-swirl and over-swirl result in loss of power and fuel economy.

Single-jet systems which are desirable on small engines demand high-swirl ratios, which are difficult to obtain in poppet-valve engines, and compression swirl is therefore the more common system on small engines. C. H. S.

346. Outlook for the Automotive High-speed Diesel Engine in Heavy-duty Transport. J. Geschelin. *Refiner*, 1934, **13**, 455–460. (Annual Meeting, A.P.I., 1934.)—The paper offers an appraisal of the future of the automotive Diesel in the U.S.A. It is shown that the present market for the Diesel comprises a good portion of the current registration of some 161,000 trucks of 2½ tons and upwards in capacity; as well as a proportion of the yearly production of about 20,000 vehicles in the same category.

Acceptance of the Diesel is based almost exclusively on fuel economy, which, under present conditions, is of the order of 60–80% of the gasoline bill. Ultimately, if and when the price of fuel oil approaches that of gasoline, the Diesel must rest on its inherent economy of the order of 30–50% saving in fuel cost. It is quite evident that the entire development depends on the fuel situation, availability of acceptable Diesel fuel, future course of fuel price, probable effect of taxation. The author recommends immediate action towards the development of minimum Diesel fuel specifications, reasonable control of fuel price, vigilant study of the tax situation, and closer co-operation between the petroleum industry and Diesel engine designers. B. C. A.

347. Detonation in Diesel Engines. W. Kamm and P. Rickert. *Z. Ver. deut. Ing.*, 1934, **78**, 851.—It is considered that by finely atomising the fuel and by using higher compression, the delay period and knocking are reduced. Increase of temperature decreases the cooling effect of the expanding fuel, and by the use of auxiliary chambers the rise of pressure produced by detonation is reduced. By using so-called "air-storage" a large amount of fuel is injected into the main chamber, the stored air securing slow combustion. L. S.

348. Wood Gas as Fuel. B. Müller. *Chem. Z.*, 1935, **59** (7), 76.—Producer plants using wood for the production of gas as fuel in stationary engines and automobiles consume about 1 kg. of air-dry wood per h.p. A good mixture consists of one-third lump wood, one-third sawdust, and one-third shavings.

Compared with gasoline, the economy amounts to about 75% in normal working. L. S.

349. Gas as Motor Fuel in Germany. M. H. Kraemer. *Z. Ver. deut. Ing.*, 1934, **78**, 1235.—The present status of the production in Germany of gaseous motor fuels is discussed. Statistics, properties, and experience with propane, butane, methane,

Ruhrgasol, coke-oven and city gas, and gases from the distillation of wood, charcoal, and brown coal are given. L. S.

350. Bitumen-dispersions in the German Patent Literature with Special Reference to their Use in Road Construction. A. van der Werth. *Asphalt u. Teer*, 1934, **34**, 1016–1019, 1037–1039.—The term bitumen-dispersions includes both emulsions and suspensions. Brief summaries are given of a large number of German patents covering the last 15 years dealing with the methods of preparation, application of dispersion to road construction, and finally of methods of preventing premature breakdown on mixing with stone. The first section includes the use of soaps, sulphonic acids, insoluble materials, and other emulsifiers. Pretreatment methods, special dispersion processes, the production of bitumen gels and patents on stabilisation are also discussed. C. C.

351. Cold Asphalt Emulsion for Road Construction. W. Latzko. *Oesterr. Chem. Z.*, 1935, **38** (1), 6.—While it is possible to use cold asphalt for road construction during about 9 months of the year, normal asphalt can only be used in dry weather during 4–5 months. Two processes are in use for preparing cold asphalts, the physical process consisting in forcing the emulsified liquid together with the hot bitumen through a colloidal mill at 2000–4000 r.p.m. The preferred method is to effect the emulsification by direct chemical action on the bituminous mass, various soaps being used as emulsifiers and stabilisers.

Normal breaking emulsions contain 40–50% of water, and the slow breaking ones (suitable for rock mixture) a greater amount of soaps.

The soaking in and sprinkling in processes are discussed. L. S.

352. Consolidating and Finishing Machine for Road Making. Anon. *Engineering*, 1935, **139**, 105.—A description, with photographs, is given of a road-consolidating and finishing machine recently brought into operation in Germany. It consists of a bridge on road wheels at each end which travels on a temporary track at the sides or middle of the road (for very wide roads) under construction. The machine is fitted with three main operating units, driven by an oil engine, viz. a levelling board, set of consolidating hammers, and a re-tamping beam. The adjustable levelling board at the front of the machine has a longitudinal horizontal vibration of about 220 periods per minute, and ensures even distribution of material, preventing occurrence of hollows and weak places in the final road. It forms the correct profile, and pushes surplus material forward on to the yet unformed part of the road, as well as giving the road material an initial compression. The consolidating hammers are rhomboidal faced steel castings (approx. 10 by 4 in.), weighing 60 kg., and fall about 6 in., making about seventy strokes a minute, being released in sequence and covering the road section completely. Behind the consolidating hammers is the re-tamping beam, which is formed to the contour of the road surface, and results in a smooth and even finish. The beam has a vertical oscillating movement of about 2½ in., making 150 strokes per minute, the force of the blows being regulated by helical springs. If necessary, the re-tamping beam may be set at an angle of 45°, so that cross lines in the surface formed by the beam will be at any angle to the wheels of traffic, ensuring smooth riding. A vibratory drag about 8 in. thick vibrating about 600 periods per minute may also be attached behind the re-tamping beam to ensure complete smoothness.

The whole machine can be adjusted vertically over a height of 6 in., and travels at about 6 ft. per minute. It can be used for the consolidation of two or more layers of concrete, the men distributing the concrete before it—or for the initial levelling of the ground. C. L. G.

353. Modern Applications of Bituminous Material for Pipe Insulation. F. Weckwerth. *Asphalt u. Teer*, 1934, **34**, 1011–1014, 1033–1037, 1053–1055.—A summary is given of the functions of bituminous material for treating iron and steel pipes against corrosion, and of the methods employed for applying the protective coating, both internally and externally. In addition to protection against rust, etc., the coating must insulate the metal against stray electric currents which cause electrolytic action. Blown bitumen mixed with carefully prepared inert filler is used for the internal treatment.

One test of the suitability of a bituminous material consists in measuring the resistance of the layer on a portion of coated pipe when immersed in 1% sodium chloride.

If the resistance falls quickly, the sample is unsatisfactory. The difference between the setting and softening points of the bitumen must be sufficient for the latter to retain its elasticity at the lowest winter temperature, while it must not unduly soften at the highest summer temperature.

Asphaltite and asphalt residues from paraffin-base crudes are unsuitable, as they do not possess sufficient elasticity. An apparatus is described for measuring the latter property. The bitumen and mineral filler used must be neutral, and paint for the inside of pipes must contain no phenol and be acid-free, whilst it must also resist the action of dilute alkali and acid. C. C.

354. Weathering of Bituminous Coatings. J. P. Pfeiffer. *De Ingenieur*, 1935, No. 3, p. Mk. 1.—The weathering of layers of asphaltic bitumen or of coal tar pitch has been studied by means of accelerated tests and by outdoor exposure. The following factors are operative:

(1) *Changes due to climatic conditions*: (*a*) a hardened, surface film is formed by the action of ultra-violet light and by oxidation; (*b*) the film (*a*) may crack as a result of temperature changes: (2) *Specific Properties of the Bitumen*: (*c*) its tendency to flow at the maximum temperature; (*d*) its ductility at the minimum temperature reached during exposure.

Two types of bitumen were studied: A. *Medium to hard bitumen* (*penetration at 25° C.*, 40–50). The film (1*a*) cracks, and the bitumen between the resulting flakes then weathers further. The flakes are forced upwards by contraction, so causing "crocodiling." Weather conditions determine the rate at which this process occurs. Deep cracks do not appear.

B. *Hard Bitumen* ("*Z*" *Type*). Shallow, but very sharp, cracks are formed initially which widen on continued weathering at moderate temperatures. If low minimum temperatures are experienced, however, the cracks penetrate the whole depth of the layer; a surface film (1*a*) forms on the sides of the cracks, and prevents closure by flowing, so that the underlying metallic or other surface remains unprotected.

Moderately blown bitumens, by reason of their special physical properties, are stated to be the most favourable to the maintenance of a continuous protecting film during weathering. P. G. H.

355. Lubrication as Affected by Physical Properties of Lubricants. R. C. Williams. *Ind. Eng. Chem.*, 1935, **27**, 64.—Data are presented for the effect of certain lubricants under the high pressure conditions prevailing in wire drawing, and previous work of Hardy and Doubleday is referred to which showed that the coefficient of static friction decreased to zero at the melting-point of solid lubricants.

An equation is employed relating total die pull to the pull required to reduce the wire and to overcome friction. The total die pull is determined experimentally, and the deformational pull calculated from experimentally determined figures for tensile strength, etc.

Beeswax and paraffin wax were found to be the most effective lubricants at normal temperatures, with copper oleate, ceresin wax, and various blended waxes in the same range of effectiveness. Higher-melting-point waxes became effective at temperatures approaching their melting-points, although at higher temperatures the coefficients of friction rose to values corresponding to those for mineral oils or other liquid lubricants at the same temperatures.

The conditions favouring minimum friction are stated to be good adhesion between the lubricant and the die or wire surface; the lubricant must be solid entering the die, and must melt or be transformed into a fairly mobile liquid under the conditions of shear prevailing in the die. F. E. A. T.

356. Colloidal Graphite as an Aid to Automobile Engine Lubrication. H. Higinbotham. *J. Inst. Aut. Eng.*, 1935, **3** (4), 79–94.—In this article the differences between the flake and colloidal forms of graphite are emphasised, and the method of manufacturing the artificial product and the manner of formation of the graphoid surface are outlined. The presence of this latter has been proved by chemical and electric diffraction methods. It is claimed that colloidal graphite improves lubrication: (1) by reducing interfacial tension between the oil and the bearing metal and increasing the degree of adhesion of the oil; (2) by increasing the amount of oil absorbed; (3) by virtue of its own lubri-

cating properties if the oil film is ruptured. Wear from corrosion is also reduced for these reasons. Reference is made to results obtained at the N.P.L. indicating postponement of seizure using an oil containing 2% of colloidal graphite, and also to Thomson's work on the Deeley machine claiming reduction of friction with a graphited oil. Furthermore, it is considered advantageous to use colloidal graphite mixed with the coolant kerosine when honing, to improve the finish of cylinder surfaces, and also as an upper cylinder lubricant in the fuel when "running-in" new engines. In this latter process the high spots are smoothed down by a method of plastic deformation, rather than by wear. Colloidal graphite does not accelerate nor retard formation of sludge in the oil. Engines can be warmed up more rapidly, with consequent reduction of wear by corrosion. Used in the lubrication of worm gears, friction is reduced, and in the case of ball and roller races fatigue is postponed by the deposition of graphite which increases the load-carrying area.

The article is illustrated with explanatory sketches, microphotographs, and contour records of piston rings and cylinder surfaces. J. L. T.

BOOK REVIEWS AND BOOKS RECEIVED.

Reviews.

ROAD-MAKING AND ADMINISTRATION. P. E. Spielmann and E. J. Elford. Pp. x + 441. 1934. E. Arnold & Co., London. 25*s.* net.

This is a particularly welcome and useful publication. The collaboration of Dr. Spielmann with Mr. Elford has produced a book which will be of practical value to everyone in any way connected with road-making. The book is divided into six parts. Part I is quite preliminary, but Part II deals more thoroughly with such important matters as "riding" qualities and safety considerations. Part III deals with construction and maintenance, and includes the main bulk of the technical information given in the book. In discussing winter work, it seems rather a pity that the authors did not condemn more strongly the serious risks that are frequently taken with the very natural desire to keep plant effectively occupied during the winter months. They give an interesting dissertation on the voids problem, and come to the conclusion that this question is now being regarded from a new angle. They state that successful roads are now being laid that would have horrified engineers of a few years ago. We wonder whether they are correct in stating that these roads are successful. We are, however, relieved to note that they postulate that real waterproofness is an essential quality if long life is to be attained.

The section dealing with fillers is particularly interesting, but it is rather surprising that no mention is made of the various mixtures of limestone flour and powdered asphaltic bitumen, which are known to give good results.

The deplorable position as regards nomenclature and definitions is set out as clearly as possible, but even the authors seem to experience some difficulty in dealing with hard asphalt, soft asphalt, and resin, and the table on page 82 is difficult to interpret in terms of the definitions on page 81. It is pleasing to see that the facts regarding sulphur and paraffin wax are stated clearly, and that the issue is not confused by the undue emphasis of personal views.

It is rather a pity that the authors have attempted, under the heading of "Refinery Products," to give tables setting out the properties of the standard grades marketed by various suppliers. Such tables are usually more commercial than scientific. They are certainly incomplete, and of only passing value. The first table on page 103 leaves one to guess whether the melting-point figures are in degrees Fahrenheit or degrees Centigrade, whilst the solubility figures given for the "cutbacks" are obviously incorrect.

The book gives much valuable information concerning road emulsions and their use, but it is perhaps a little surprising that no mention is made of the Lability Test.

The whole subject of cement and concrete is treated very fully, and all other forms of construction of practical value are dealt with in an informative manner.

While traffic signs and control signal lights are of topical interest, it is felt that rather too much space has been devoted to them.

The book contains a very full and valuable bibliography, and while the appendices are useful, they tend to give the general impression that the high standard attained in the main body of the book has not been maintained throughout the closing chapters. The whole subject of road-making and administration has, however, been treated in a very able, interesting, unbiased, and comprehensive manner, and the book will be of undoubted value, particularly in view of the very limited amount of literature available on this and similar subjects.

J. S. JACKSON.

BRITISH STANDARDS INSTITUTION'S SPECIFICATIONS FOR ASPHALT.

The British Standards Institution have recently published the following series of specifications dealing with Asphalt :—

No.

594—1935. Rolled Asphalt (Fluxed Lake Asphalt and Asphaltic Bitumen). Hot Process.

595—1935. Rolled Asphalt (Fluxed Natural Asphalt and Asphaltic Bitumen). Hot Process.

No.
596—1935. Mastic Asphalt (Fluxed Lake Asphalt and Asphaltic Bitumen). Hot Process.
597—1935. Mastic Asphalt (Fluxed Natural Asphalt and Asphaltic Bitumen). Hot Process.

B.S.S. No. 594—1935 supersedes B.S.S. Nos. 342, 343, 344, and 345, published in 1928, and incorporates modifications and improvements considered desirable in the light of five years' experience in the application of these specifications.

The four earlier standards have been combined in one publication, comprising a section giving the general clauses applicable to each of the four types of construction, together with four separate sections, each giving the additional clauses applicable to each type of construction respectively.

B.S.S. 594 includes detailed specifications for three types of Asphaltic Cement: (1) Asphaltic Bitumen; (2) Refined Lake Asphalt (Fluxed); (3) Equal Proportions of Asphaltic Bitumen and Refined Lake Asphalt.

The requirements for the physical properties of the stone for the wearing surface are also stated.

The new specification includes schedules of the compositions of final mixtures as shown by analysis. These schedules cover a greatly increased range of mixtures.

The scope of the specifications formerly issued for Clinker Asphalt has been extended to cover crusher-run limestone, slag, and igneous rock in addition to clinker.

The constructions dealt with are all designed to provide surfaces of a non-skid character.

B.S.S. No. 595—1935 is drawn up along similar lines, but covers the use of natural asphalts (other than Lake and Rock Asphalt).

Both these specifications provide for the four following types of construction: (*a*) Two-coat asphalt (hot process, sand or sand and stone aggregate wearing surface); (*b*) two-coat asphalt (hot process, crusher-run aggregates (clinker, limestone, slag, and igneous rocks)); (*c*) single-coat asphalt (hot process, stone and sand aggregate); (*d*) single-coat asphalt (hot process, crusher-run aggregates (clinker, limestone, slag, and igneous rocks)).

B.S.S. No. 596—1935 supersedes B.S.S. No. 346 for Mastic Asphalt Surfacing which was published in 1928.

Here, again, three types of Asphaltic Cement are included, but the principal modification is the sub-division of the specification into two distinct sections, providing for the following two types of construction: (*a*) Mastic asphalt surfacing with limestone aggregates; (*b*) mastic asphalt surfacing with natural rock asphalt aggregate.

B.S.S. No. 597—1935 is drawn up along similar lines, but covers the use of natural asphalt rather than lake or rock asphalts.

Both constructions are designed to provide non-skid surfaces.

In all cases the necessary methods of examination are given in appendices, and a special appendix indicates the information which must be supplied by the engineer in his invitation to tender.

The specification stipulates that the Asphaltic Cements shall be tested by the methods set out in the current edition of "Standard Methods of Testing Petroleum and its Products" as published by this Institution. J. S. JACKSON.

Books Received.

AMERICAN SOCIETY FOR TESTING MATERIALS: PROCEEDINGS, 1934. Vol. 34, Part I. Committee Reports. Tentative Standards. Pp. 1325. 8vo. 1934, A.S.T.M., Philadelphia. $8 bound in cloth; $7 in paper covers.

The reports of the various Committees of the A.S.T.M., which were presented at the 37th Annual Meeting, are given, together with full details of the Tentative Specifications and Methods of Test as issued and revised in 1934. The tentative revisions of the A.S.T.M. Standards are also included.

AMERICAN SOCIETY FOR TESTING MATERIALS: PROCEEDINGS, 1934. Vol. 34, Part II. Technical Papers. Pp. 943. 8vo. 1934, A.S.T.M., Philadelphia. $8 bound in cloth; $7 in paper covers.

This volume reports the proceedings of the 37th Annual Meeting of the A.S.T.M. It includes the following papers and discussions of interest to petroleum technologists:

"The Use of Bureau of Standards Soil Corrosion Data in the Design and Protection of Pipe Lines," by K. H. Logan; "Motor and Fuel Vapour Pressures," by T. A. Boyd; "Motor Fuels and Vapour Lock," by G. G. Brown; "Bituminous Joint Compounds for Sewer Pipe," by J. S. Crandell; "Indentation of Asphalt Tile," by J. W. McBurney; "A Laboratory Service Test for Pavement Materials," by A. T. Goldbeck, J. E. Gray and L. L. Ludlow; "The Testing of Rubber and Rubber-Like Materials for Oil Resistance," by O. M. Hayden.

ASSOCIATION OF BRITISH CHEMICAL MANUFACTURERS: BRITISH CHEMICALS AND THEIR MANUFACTURERS. Pp. 459. 8vo. 1935, A.B.C.M., London.

The 1935 edition of the Directory of British Chemical Manufacturers contains detailed information regarding the various chemicals produced in Great Britain. It is printed in English and five other languages, viz.: French, Spanish, Italian, Portuguese and German, and should be of great benefit to purchasers in all parts of the world.

The book is published gratis, and can be obtained by genuine purchasers of chemicals on application to the Association at 166, Piccadilly, London, W.1.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE: REPORT OF ANNUAL MEETING, 1934. Pp. 620. 8vo. 1934, British Association, London.

The 1934 Annual Meeting of the British Association was held in Aberdeen, Sept. 5–12, 1934, and the Report contains the addresses delivered by the Presidents of the various sections. The papers presented to the various sections are given in summary, and an appendix of 147 pages contains a scientific survey of Aberdeen and District.

FUEL RESEARCH BOARD. THE YORKSHIRE, NOTTINGHAMSHIRE AND DERBYSHIRE COALFIELD. WEST YORKSHIRE AREA. UPPER BEESTON SEAM, PART I. Survey Paper No. 35. Pp. vi + 103. 1935, H.M. Stationery Office, London. 2*s.* 6*d.* net.

Gives detailed data regarding the Upper Beeston Seam, which is the most extensively worked seam in the whole West Yorkshire area. It is stated that the coal in the northern part of the area examined is suitable for low-temperature carbonisation, producing a fairly strong, unswollen coke.

INSTITUTION OF MECHANICAL ENGINEERS: PROCEEDINGS, Vol. 127, 1934. Pp. 458. 8vo. 1934, Inst. Mech. Eng., London.

This contains the papers presented and discussed at meetings of the Institution during the period April–November, 1934, together with a number of papers selected for publication. Two papers are likely to be of interest to petroleum technologists, viz.: "Gas Works Practice," by F. M. Birks, and "The Operating Temperatures of Cast Iron and Aluminium Pistons in a 12-inch Bore Oil Engine," by H. Wright Baker.

NEW ZEALAND OFFICIAL YEAR-BOOK, 1935. Pp. 748. 8vo. 1934, Govt. Printer, Wellington. 7*s.* 6*d.*

The forty-third issue of the Official Year-Book for New Zealand includes detailed vital and trade statistics of the Dominion.

During 1933, the total production of petroleum from the two wells at New Plymouth was 169,675 gal. The total production to December 31st, 1933, is estimated at 2,067,464 gal.

SOUTH METROPOLITAN GAS CO.: THE SOLID PRODUCTS OF THE CARBONISATION OF COAL. Pp. 123. 8vo. 1934, S.M. Gas Co., London.

This work deals particularly with the production of smokeless fuel by the carbonisation of coal, and presents the information which has been accumulated by the Chemical Department of the South Metropolitan Gas Co. over a period of several years.

ABSTRACTS.

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Class 100. Geographic Occurrence.

357. Petroleum Resources in Argentine. T. T. Serghklescu. *Mon. Petr. Roum.*, 1935, **36**, 11–20, 91–98.—This article reviews the development of the petroleum industry in Argentina from its initiation in 1907, with the discovery of the well Gulf Saint George at Comodoro Rivadavia, until the present day. The circumstances leading to the discovery and the geological formation of the various oil-bearing regions are discussed. These regions are situated at Oran, Cacheuta, Sosneado, Tupungatu, Plaza Huincal, and Comodoro Rivadavia. Statistics relating to total yearly production of petroleum since 1907, production of petroleum, gas, and casing-head gasoline from each district by the various organisations operating in Argentina, and production and imports of all petroleum products for the years 1926–1933, are given. Information regarding properties of the different petroleums, refineries, transport, import duties, etc., is also given. A. O.

358. Norwegian Petroleum Market in 1934. J. T. Sviland. *Mon. Petr. Roum.*, 1935, **36**, 231.—In general, 1934 represented better conditions in the economic life of the country. In the petroleum industry this was noticeable in that increased consumption of products took place, due to increased numbers of motor vehicles and greater activity of the fishing fleet. Imports increased, and the figures for 1932–1934 are given. The market prices of the various grades, gasoline excepted, fluctuated a little during the year. Customs dues are enumerated. W. E. J. B.

359. Petroleum Occurrences in China. Anon. *Petr. Z.*, 16.1.35, **31** (3).—Oil and wax occurs in small quantities in fissures in the Kutscha hills, 38 km. W.N.W. from Kutscha. There are similar occurrences near Muskau, 68 km. N.N.E. from Kutscha.

Thick, tarry oil occurs in mesozoic strata in the Gobi desert. South of the Gobi desert, at the foot of the Nan-shan hills, in the province of Kan-su, oil is collected daily in a dozen pits 1 metre deep. Oil is also found at the source of the River Shi-yu-ho.

There are oil-shows in hilly districts in the province of Shan-si. The oil there is of low gravity, and occurs in sandstones and shales which are probably mesozoic in age. Oil-shows are very common in a large area in Ordos (S. Mongolia), around the swing in the course of the Hwang-ho River.

Oil deposits have been exploited in the central regions to the east of Chang-fu in the Red Basin, but the results have been poor. Oil has also been found in mesozoic strata on the upper Min-ho.

Borings undertaken recently have pointed to important fields occurring in Tszeshan, N. Shen-si, and Kan-su. The fields in the neighbourhood of Tsuliasing, N.E. of Fushun, are to be developed first. A survey has shown that large oil reserves are to be expected in West Kan-su, particularly in the area from Yumen to Chiuchwan and Tumhuang. The Nanking Government has proposed a four-year plan for the development of these resources. S. E. C.

Class 200. Geology and Origin.

360. Esperon Dome, Liberty County, Texas. W. L. Goldston and G. D. Stevens. *Bull. Amer. Assoc. Petr. Geol.*, 1934, **18**, 1632–1654.—The Esperon dome is situated between the Barbers Hill dome and the North Dayton dome. There are no surface indications of the dome, the discovery being made by torsion balance survey in 1928.

Oil production is from lenticular sands in the Oligocene and Miocene, there being two sands in the Oligocene and five in the Miocene. Gas also occurs in three sands in the Yegua formation (Eocene), but no wells have so far been completed in those horizons.

The structure is similar to many found on the Gulf Coast, but is peculiar in that the top of the dome, as reflected in beds above the salt, changes in horizontal position with depth. It is concluded that the salt-mass is inclined northwards, and that the beds are folded above a line perpendicular to the base of the salt. Uplift increases in intensity with depth; at the surface it is practically nil, whilst in the Yegua it is 2500 ft. Movement of the salt began before the end of the Yegua, and continued until the Pliocene, with a period of maximum intensity at the end of the Eocene and beginning of the Oligocene. The producing sands are independent of one another, overlap one another on top and on the flanks of the structure, and, in general, thin out at the top and thicken on the flanks. The proven acreage is approximately 400 acres, with an extra 300 acres semi-proven. Total production so far is almost 7000 brl. per proven acre, and gas pressures are low. S. E. C.

361. Prediction of Overhang at Barbers Hill. D. C. Barton. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 25–36.—The object of the work described in this paper is to determine whether overhang similar to that obtained at Barbers Hill may be predicted in advance of drilling. The data used were three diametral lines of stations across the Barbers Hill dome, known drilling data concerning the cap, and knowledge of probable density relations. Calculations were made by the author's graphical method for a series of assumptions for the density relations, shape of the salt, and the regional gradient. For those calculated gradient profiles which were in reasonable agreement with the observed gradient profile, the mean square of differences between calculated and observed values was used to determine which fitted best. The results of this study show that the overhang can be predicted, and that in this case there appears to be considerably more overhang on the N.E. than on the S.W. It should be possible to apply this type of calculation to determine overhang in other domes. Accuracy is enhanced when the cap rock has been well drilled and the dome is located far enough from the sea for the coastal zone of low density sediments to have little effect. The method has the advantage of being independent of flank wells. S. E. C.

362. Barton Arch in Central Kansas indicates Major Oil Province. E. G. Woodruff, *Oil & Gas J.*, 7.3.35, **33** (42), 12–14, 32.—The major structural features of Kansas are discussed, and attention is directed to the possibilities of further large oil-pools being discovered on and around the Barton Arch and the Nemaha Granite Ridge.

The Barton Arch has a general N.N.W.–S.S.E. trend, and the Nemaha Granite Ridge strikes N.N.E.–S.S.W. Between these two uplifts is the Salina Basin, to the S.W. of the Barton Arch is the Dodge City Basin, and to the S.E. of the Nemaha Granite Ridge is the Cherokee Basin.

The Barton Arch is thought to have been an uplift in the granite basement covered by a thick mass of Arbuckle Lst., Simpson, Viola Lst., Sylvan, and possibly later formations. Erosion of the crest of the uplift exposed the beds as far down as the Arbuckle before the area subsided below the sea, where Mississippian, Pennsylvanian, and Permian deposits were laid down. Oil accumulations are anticipated just below the unconformity along the base of the Mississippian.

Many pools have already been discovered and developed in the Arbuckle Lst., Simpson (Wilcox), Viola Lst., and production has proved that the area is of major importance.

Maps and sections accompany the paper, and also a short review of the present drilling activities and methods. J. A. G.

363. Pre-Pennsylvanian Stratigraphy of Nebraska. A. L. Lugn. *Bull. Amer. Assoc. Petr. Geol.*, 1934, **18**, 1597–1631.—This paper is divided into two sections. The first is a discussion on the pre-Cambrian rocks, and the second on the pre-Pennsylvanian palæozoic rocks.

The pre-Cambrian rocks are quartzites, schists, and granite. It is doubtful whether the quartzite is of the same age as the schist, or younger; both are somewhat older than the granite. The pre-Cambrian surface is a series of ridges and wide valley features. The N.E. part of the State is underlain by the Sioux quartzite, which reaches the surface at Sioux Falls. To the south, but separated from it by the Omaha saddle,

are the buried Nemaha mountains. These are formed by a granite ridge, the east slope of which is a steep fault scarp. South-west from the Sioux Falls "high," and westwards from the Nemaha ridge, the surface slopes down into the Central Nebraska basin, of which little is known. This again is limited in the S.W. and N.W. by another series of "highs." It is probable that these features were the result of orogenic movements at the end of the pre-Cambrian, with the result that, during early Palæozoic, deposition sediments progressively overlapped one another on their flanks.

All pre-Pennsylvanian palæozoic rocks are present east of the Nemaha ridge. The exact distribution of these rocks to the west is unknown, and, while many are missing in some of the wells, it must be remembered that most of the wells were located on "highs." It is therefore quite possible that they may be present in the basins and valleys on the pre-Cambrian surface. The lowest member is the Red Clastic Series and its age is doubtful; it may either be pre-Cambrian or mid-Cambrian. The true Cambrian formations are upper Cambrian in age. Ordovician rocks have been identified in test wells, whilst the earliest Silurian rocks known in Nebraska are of mid-Silurian age. Devonian rocks are known only in the eastern part of the State, whereas Mississippian rocks are known over the whole. The Mississippian was followed by a period of uplift and erosion, so that the Pennsylvanian was deposited on a very irregular surface.

The number of deep test wells is small, and it cannot be claimed that Nebraska has been adequately tested for oil and gas, especially since many of these wells were located on buried "highs." There is, however, very little evidence that oil and gas do occur. S. E. C.

364. Oil Shales in the Alps. G. Kurre. *Petr. Z.*, 13.2.35, **31** (7), 4–6.—Numerous beds of lignite and bituminous limestone occur in the Alpine Trias. The bituminous rocks vary from being finely laminated to greyish-black, compact masses. The bitumen content of the impregnated limestone varies from 10% to 20%, and at a few localities even reaches 30%. Dry distillation of the oil shale yields a neutral oil which has a sulphur content of 4–11%. The greater part of the sulphur is in the form of thiophene derivatives. At Melide, in Canton Tessin, and at Seefeld, between Mittenwald and Innsbruck, these shales are worked and the oil is used for pharmaceutical preparations. At Kufstein–Schaftenau the oil obtained has not sufficient sulphur content to render it of value for pharmaceutical preparations, and yet too high a sulphur content for the economic preparation of lubricating oils. A brown lignite and a lenticular bituminous dolomite occur in the Bavarian Alps in the upper reaches of the Isar, and these yield an oil suitable for pharmaceutical purposes, although unsuitable for lubricating purposes. S. E. C.

365. Study of Structure of Suwa Basin, near Kyoto, Japan, by Torsion Balance. M. Matsuyama, Y. Fujita, and H. Higashinaka. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 58–63.—A torsion balance survey was carried out in order to examine the theories concerning the origin of the Suwa Basin and Lake Suwa. The geological and geophysical view-points are examined, and the paper provides an example of co-operation between the geologist and the geophysicist. S. E. C.

366. Bosco Detailed Sub-surface Geological Data Aids Operations. C. Leyendicker. *Oil Weekly*, 25.2.35, **76** (11), 66.—The Bosco field is being developed with the greatest accuracy possible to determine the geological formations and define the faults that may exist.

The area was worked with refraction seismograph in 1929, and later checked with torsion balance, and it is interesting to note how well the field now compares with these results obtained prior to its discovery.

The limits of the field were obtained as the result of seven tests.

Electrical logging has assisted greatly in determining geological conditions, and from graphs and other geological and engineering data obtained from cores it is possible to determine depth and probable character of sub-surface formations.

Three producing sands are known, and the author gives some details of these.
L. V. W. C.

367. Effect of Anisotropy on Apparent Resistivity Curves. S. J. Pirson. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 37–57.—A "successive approximation method" is proposed for the extension of Tagg's two-layer method of depth determination to the case

of three horizontal layers. The layers in question must either be homogeneous and isotropic, or the individual layers must have the same coefficient of anisotropy for the successful application of the method. An expression is developed for the apparent resistivity in a three-layer case when the individual layers have the same anisotropy. From a consideration of the theoretical resistivity curves in such a case, a number of conclusions are reached. For anisotropies greater than one, the points of maximum curvature shift towards smaller electrode spacings. For coefficients of anisotropy less than one, the anomaly in the resistivity curve is reduced; for coefficients greater than one, the anomaly is increased and the curves are flattened. Tagg's method of depth determination gives a solution which is multiplied by the square root of the anisotropy coefficient. The Gish–Rooney rule is approximately true when the anisotropy coefficient is $\frac{1}{2}$. To illustrate the method an example concerning the determination of the depth of the water-table in the Newman district, New Mexico, is given. S. E. C.

368. Recent Developments in Gravity Prospecting on the Gulf Coast. O. F. Sundt. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 19–24.—Prior to the discovery of the Sugarland dome, gravity minima were considered to be of only secondary interest. Since then eighteen domes have been discovered by the torsion balance, and of these only one is represented by a gravity maximum. This exception is Fannet, and it is shallow; the others are more or less deep-seated.

Smaller instruments, the substitution of tungsten torsion wires for platinum–iridium wires, with a consequent reduction of errors due to temperature effects, and recognition of the need for proper adjustment of the torsion head have all introduced economies in working. A new type of balance, with the beams hung at an angle on a double suspension attached at the bottom of the torsion wires, has reduced the time necessary to complete a station to 1 hour 40 minutes. Pendulums are used for regional gravity prospecting, and the Cleveland dome was discovered by the pendulum. One type uses quartz instead of an invar pendulum, and is sensitive to about 3×10^{-4}. Gravity meters consisting of a weight suspended on a delicate spring are also sensitive to about 3×10^{-4}. They enable a large area to be covered very quickly, but need very careful handling and levelling, and must be kept constantly at an even temperature.

Local torsion balance surveys are being connected to determine the regional trend of gravity maxima and minima. This trend is more or less parallel to the coast-line, and salt-domes seem to be located on the flanks of these features rather than on maxima or minima. S. E. C.

369. Influence of Geological Factors on Longitudinal Seismic Velocities. B. B. Weatherby and L. Y. Faust. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1–8.—An analysis of velocity measurements taken in fifty different wells was made to examine the truth of the statement that the longitudinal seismic velocity of sediments increases with the age of the sediment. The difference in depth between two points in a well divided by the difference in times of arrival of the wave at those points gives the differential velocity of that section, and it is that velocity which is of significance in this analysis. Sections were chosen in which the lithology remained reasonably constant at different periods of geological time. In the case of non-calcareous shales and sandstones, it is shown that the velocity does increase with age. Limestones provided a more difficult case, since most of the sections were of small depth, and weathering no doubt had some effect on the results obtained. In general, however, a similar condition seems to hold. Velocities in calcareous shales are considerably higher than in non-calcareous shales. On the basis of the formula for longitudinal velocity it can be shown that increase in velocity is due to increase in the bulk modulus and in the rigidity of the sediment. An increase in density of the sediment tends to reduce the velocity. It is therefore suggested that the increase in velocity due to age is a function of cementation and of compaction. S. E. C.

370. Effect of Moisture upon Velocity of Elastic Waves in Amherst Sandstone. W. T. Born and J. E. Owen. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 9–18.—The natural frequency of a bar of Amherst sandstone, 4 ft. long and 2 in. square, was measured, the moisture content being varied. The sample was a comparatively pure sandstone with 23% porosity, and the cement was to some extent ferruginous. It was found that the first additions of moisture caused a rapid reduction in frequency, this reduction

becoming slower as further water was added. This action appears to be reversible. The natural frequency is proportional to the "bar velocity," which in turn is related to the "bulk velocity" of the rock. It therefore follows that the wave velocity in the rock will be affected by the moisture content in a similar manner to the natural frequency. Measurements of the Young's Modulus under similar conditions showed a similar effect, and this points to the fact that moisture alters the elastic properties of the cement. S. E. C.

371. Deep Electrical Prospecting. J. C. Karcher and E. McDermott. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 64–77.—Electrical prospecting is here considered from the point of view of locating electrically resistant media, such as oil- and gas-sands. Depths of the order of 2500 ft. are considered. In order to determine such media, their lateral dimensions must be at least several times as great as their depth below the surface. Two current and two potential electrodes are used, the potential electrodes being in line with the current electrodes and outside them. The current spread is ½ mile. An input of 10–20 amp. is delivered from a storage battery of several hundred volts, the electrodes being a system of copper rods. The potential electrodes are the usual non-polarising pots. This input current is interrupted at regular intervals of 10 sec., and in consequence an inductance effect can also be measured. The method is illustrated by examples of surveys in three areas. In the case of the first—the Hugoton gas-field, Kansas—the sand is at a depth of ½ mile, and has a great extent, thus fulfilling the necessary conditions for successful application of the method. The other two areas proved to be unsuitable. S. E. C.

372. Normal Geothermal Gradient in United States. C. E. van Orstrand. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 78–115.—A summary of geothermal data in the United States was published in 1920 by Darton. Those temperatures were obtained mainly in flowing wells. Since then records have been obtained from 700 non-flowing wells, mostly located in the oil-producing states. These data are here summarised and tabulated for different groups of depths. Similar tables are also given which take into account the variation of temperature with structure. The various methods of averaging the results are discussed, the meaning of the term "normal gradient" depending on the method used. The results show that the normal depth–temperature curve is convex to the depth axis. A similar effect is shown in the case of observations from oil wells on the flanks of a structure, except that the reciprocal gradients (ft. 1° F.) are smaller, as a result of the higher temperatures in oil-fields. In the case of data from the crests of anticlines, the depth–temperature curves approximate to a straight line. By comparing the gradients obtained in sedimentary rocks with the gradients obtained in rocks of the Canadian shield, it is concluded that there are two types of normal gradient: one for sediments, and one for only slightly disturbed basement rocks. The average of a large number of gradients covering the area of the U.S.A. for the first 1000 ft. of sediments is greater than 60 ft. per ° F. and less than 110 ft. per ° F. The wide range in those figures is due to lack of observations in the large areas surrounding domes and anticlines. For depths greater than 1000 ft. those figures should probably be reduced S. E. C.

Class 300. Development and Production.

373. West Texas Completion Practice prevents Contamination. B. Mills. *Oil Weekly*, 25.2.35, **76** (11), 37.—A method of drilling-in under control is being applied successfully in a number of West Texas fields to prevent contamination of the producing formations. Oil is used as the circulating fluid, and high-pressure gas is injected to keep this fluid moving freely, to aerate the column, and to assist in bringing the cuttings to the surface.

Pressure equipment and flush-joint drill-pipe are required.

A description of the operation of this method is given, together with a flow chart for oil and gas as used in the Ector County Wells. L. V. W. C.

374. Rumanian Deep-Drilling Technique. O. V. Erbiceanu. *Oil Weekly*, 10.2.35, **76** (9), 35.—The Creditul Minier, S.A.R.'s Chitorani 1, is the third deepest well in the world, and this test has enabled the world to learn something of Rumanian methods and applications of technique in handling shale caves, standard and electrical coring.

This well reached a depth of 11,092 ft. in just over four months.

Heaving shale formations caused considerable trouble as the bit neared the final depth. As soon as the bit was pulled out for changing, this shale continuously caved into the hole, and this was the only serious trouble encountered that delayed the finish of the well. One drill-collar was lost when coring shale and a nineteen-hour fishing job resulted. No twists-off or other fishing jobs occurred during the entire drilling of the well.

A description of the lay-out and the complete operations is given, together with pictures of the various parts of the rig. L. V. W. C.

375. Pressure-Drilling.—A Developed Drilling Technique. W. A. Sawdon. *Petr. Eng.*, February 1935, **6** (5), 40.—Pressure-drilling methods are assisting in the drilling and completion of high-pressure formations. In areas where the rock pressures are excessive, pressure-drilling will usually be found advantageous, and there are certain conditions, such as where gas cutting will endanger the operations, or where the formations must be mudded off without the use of weighting materials and others, which will make its use very desirable.

Pressure-drilling has been used since 1921, and the highest pressures overcome were probably those encountered in the Khaur Field, Punjab, India, in 1932. In the well in question a balance was struck where the well neither made nor took fluid. This was obtained by means of beans in the discharge lines.

The equipment necessary for pressure-drilling must, in general, provide a snubbing device for running the drill-pipe or casing, a stuffing-box head for lowering and raising the pipe and for rotation and at the same time maintain pressure by sealing the annular space between the set casing and the drill-pipe or casing being run, control gates to pack off around the pipe being run, a chamber to permit the insertion or removal of the bit, drill-collar and tool joint without dissipating the pressure, and mud outlets for the returns and for pumping in mud to replace the pipe with fluid and maintain pressure when necessary.

To prevent the flow up the drill-pipe, a back-pressure valve must be placed above the bit or drill-collar, and a float collar and float shoe, or two float collars, should be provided when running casing. L. V. W. C.

376. Pressure-Drilling at Yates Accomplished Successfully with Light Equipment. B. Mills. *Oil Weekly*, 11.2.35, **76** (9), 32.—Light rotary equipment is used in the Yates Field for bringing in or deepening wells under pressure. A number of original ideas are embodied in this equipment, which has been especially built for this work.

The outfit consists of a 20–30-h.p. tractor, a 3½-in. tubular drive to the jack shaft, short vertical drive between the jack shaft and rotary table, two blow-out preventers, heavy steel foundation, and a heavy two-post mast.

At 200 r.p.m. at the drive-shaft the table revolves at 60 r.p.m., and the drill-pipe is either 2⅞ or 3½ in.

The mast is 54 ft. high, and is made of 8⅝-in. seamless casing.

Another type of rig utilises a 25–65-h.p. electric motor. L. V. W. C.

377. Greatest Activity in Mid-Continent Region in Fitts Field, Oklahoma. L. G. E. Bignell. *Oil & Gas J.*, 7.2.35, **33** (38), 10–11.—The Fitts Pool, Southern Pontotoc County, Oklahoma, is one of the most active fields in the United States of America.

Practically all the wells in this field have been drilled and completed with rotary outfits. The starting diameter is usually 17 in., and this is carried to about 800 ft. At this depth 13⅜-in. casing is landed and cemented the full length. Eleven-in. casing is set as deep as possible, and the critical depth to which it is necessary to carry this string is approximately 1900–2000 ft. The 7-in. string is then set at 4200 ft.

The mud used in drilling the upper portion of these holes has an average weight of about 10½ lb./gal., giving a pressure of about 54·4 lb./100 ft. of hole. This equals about 350 lb./sq. in. pressure at the bottom of a 600-ft. hole, and every precaution must be taken against blow-outs while drilling in the upper 17-in. hole. As the hole is drilled deeper the mud is more effective in controlling formation processes.

Caving formations have been penetrated in many of the holes, and these shales are the same as those used for making cement at a nearby plant, and therefore mud-making in themselves. The viscosity of the mud is changed, and where limestone is penetrated the mud is often thickened to such an extent that the pumps have difficulty in handling the muds from the pits.

The holes in this field have been drilled with small deviation; the verticality of the holes is checked frequently, and if the deviation is too great the hole is plugged back and straightened.

One well to each 10 acres is the present spacing plan. L. V. W. C.

378. Performance of Bits Brazed with Vokar and Pobedit. N. L. Vartasanov and E. V. Chermuisheva. *Azerb. Neft. Khoz.*, 1933, **2**, 20–33.—Vokar contains 11·9% C, 84·7% W, 1·1% Fe, and 0·3% Si, while pobedit contains 5% C, 80·25% W, 8% Co, 1·86% Mo, and 5·24% Fe. Under identical drilling conditions the bit brazed with vokar powdered alloy gave the better results. Full details are given.

For. Petr. Techn.

379. Brazing Bits with Natural Gas. K. Mikhailov. *Azerb. Neft. Khoz.*, 1934, **2**, 33–35.—Bits were brazed with copper using pobedit, the operation being carried out with natural gas and oxygen. Because of the lower temperature used the alloy structure was little affected and the bit was more resistant. It is concluded that savings can be effected by using natural gas, and that the hard alloy may be taken off from dull bits and used again on new bits.

The results are tabulated. For. Petr. Techn.

380. New Rotary Feed Control. Anon. *Petr. Eng.*, February 1935, **6** (5), 27.—An entirely new type of rotary feed control has recently been developed, the power required for actuating the control being derived solely from the tension in the drilling line. The torque in the drum shaft resulting from the tension in the line is utilised to drive a small pump through a reduction gear. Water is used as the fluid, and the discharge rate of this small pump governs the rate of feed of the bit. Any desired rate can be obtained by adjusting the size of the outlet on the discharge line of the pump.

The unit is self-contained, and can be installed and moved with ease.

In operation the control is automatically disengaged when making a round trip or adding a joint of drill-pipe. To resume drilling, the bit is lowered to bottom, and is then picked up about 3 ft., at which time one drive clutch is engaged and the hoist brake is entirely released. Opening the largest orifice valve in the discharge manifold lowers the bit to bottom. When the bit reaches bottom all the valves are closed except the one that provides the desired rate of feed. Rotation is then carried on as in ordinary practice.

Drawings are given to show the working of this unit, and a number of advantages are quoted. L. V. W. C.

381. Construction and Durability of Wire Ropes. W. Kolodziej. *Przem. Naft*, 1934 (16–18), 435, 472, 507.—Wire ropes are used for three purposes in the petroleum industry in Poland: (1) for drilling; (2) for pumping; (3) for handling casing, etc. They are generally of left-hand lay of six strands round a hemp core.

Drilling ropes are usually of 26 and 22 mm. diam. with a tensile strength of 140–149 kg./sq. mm. The chief cause of failure is by abrasion of the wires in the lower part of the rope.

Pumping lines are of 12–16 mm. diam., although the tendency is to use thinner ropes. Each strand usually consists of seven wires each of 1–1·6 mm. diam., but in some cases five strands of three wires each have been used. The tensile strength is about 150–169 kg./sq. mm.

Casing ropes are in most cases 23·5 and 26 mm. in diam., etc., individual wires being 1·1 and 1·2 mm. diam., with a strength of 130–149 kg./sq. mm.

The main problem of rope durability is the resistance to abrasion. E. F.

382. Direct Current Rotary Drilling Rig. S. J. Kline. *Oil Weekly*, 25.2.35, **76** (11), 33.—A description is given of the application of the D.C., variable-voltage system of speed control to rotary drilling, together with the evolution of a dual unit arrangement which enables a steadily maintained service with but one unit in operation. A wide range of flexibility is possible with this system. L. V. W. C.

383. Preliminary Evaluation of Commercial Drilling Clays. I. F. Bingham and H. Sidwell. *Oil Weekly*, 11.2.35, **76** (9), 29.—Mud fluid is a very important factor in the successful drilling and completion of a well, and the qualities of the mud depend on the substances from which it is made.

Rotary drilling muds are produced by mixing water and clay suspensoids, and are used in general to cool and lubricate the bit, to carry the cuttings from the hole, and to build and maintain the walls of the hole.

This paper sets out a few simple tests which may be carried out in any field laboratory for the evaluation of a commercial clay from three standpoints: (1) % of clay; (2) % of particles too large to stay as suspensions; (3) % of abrasive particles.

The method of preparing the samples for classification and the method of classification are given, together with diagrammatic sketches of the apparatus required.

L. V. W. C.

384. Notes on Barytes Recovery from Muds. G. H. Scott. *J.I.P.T.*, 1935, **21**, 89–104.—A paper with discussion at the Trinidad branch on methods that have been examined for the recovery of barytes from muds. G. R. N.

385. Economics of Pumping and Gas Lift. T. W. Dagg. *J.I.P.T.*, 1935, **21**, 25–35.—A paper with discussion at the Trinidad branch on some of the principles involved in the choice of pumping or gas lift as alternative methods. G. R. N.

386. Study of Oil-Field Water Analysis, Part IV. W. R. Wiggins and C. E. Wood. *J.I.P.T.*, 1935, **21**, 105–119.—An account of the development of a volumetric method of estimating sodium by means of zinc uranyl acetate, with some notes on the errors that may be introduced by the presence of ions of potassium ammonium, magnesium, and calcium. G. R. N.

387. Natural Gas and its Occurrence in the Nienhagen Oil-Field. Anon. *Chem. Ztg.*, 1935, **59**, 136–137.—A brief outline is given of the composition, production, and applications of natural gas.

The approximate average composition by volume of the gas from the Nienhagen field is: carbon dioxide 0·5%, methane 80%, other paraffins 15%, nitrogen 4·5%, density (air = 1) 0·7 — 0·8. C. C.

388. Methods for Obtaining Pressure in Oil Production and their Significance. S. F. Shaw. *Oil Weekly*, 4.2.35, **76** (8), 33.—Modern methods employed for extracting oil require a study of the various pressure conditions in an oil-field.

A pressure-gauge at a point between the compressor or separator and the well will enable the pressures to be read with some degree of accuracy, especially if a calibrated test-gauge is used.

Pressures below the well-head must be obtained by: (1) reading the pressure gauge at the surface and allowing for the weight of the column of gas; (2) calculation of friction loss; (3) by the use of pressure bombs.

In a well that is tubed and flowing naturally it is possible to measure the bottom hole pressure by injecting a small quantity of gas through the tubing or casing, depending on whether the flow is through the casing or tubing, until there is no further rise in pressure. The weight of the column of gas must be added to the pressure to obtain the flowing pressure at the bottom of the well.

A knowledge of flowing pressures at the bottom of the tubing is of the greatest importance in ascertaining the production that it is possible to lift either by natural flow or by gas lifting. L. V. W. C.

389. Practical Application of Petroleum Solubility and Lubrication Phenomena. B. E. Lindsly. *Oil & Gas J.*, 24.1.35, **33** (36), 37.—Work on the solubility of natural gas and air in crude oil has shown that surprisingly large volumes can be dissolved, and that the effect of this is to decrease the viscosity, surface tension, and specific gravity of the oil. In addition, the data published show that the lighter oils dissolve more gas at given pressures and temperatures than the heavier oils, that within limits the amount of gas an oil will dissolve increases with lowering of temperature, and that the hydrocarbons forming the gas occupy space when dissolved in oil, and, conversely, the oil shrinks in volume when gas is liberated from it.

Most of the data were in fair agreement, but in some cases the solubility graphs were curved, in others they were straight lines substantially in agreement with Henry's Law. The author found, after a detailed study of the subject, that when a phenomenon called "selective" solubility occurs, the solubility graphs will be curved. On the other hand, if the experiments are conducted in such a manner as to prevent this

phenomenon from occurring, the data obtained will approximate the relations expressed by Henry's Law.

These principles have a practical application which can be appreciated by considering the effect of liberation of gas on the reservoir oil of a normally operated field and the re-pressuring of an oil-field by pumping gas into the oil-sand the productivity of which has approached the economic limit as the result of normal operations.

The study of bottom-hole samples should be expanded in order that more data may be available to determine the energy contained in the reservoir necessary to propel the oil through the sand to the well.

The possibility of estimating oil reserves from data obtained by examination of bottom-hole samples is another aspect of solubility investigations. L. V. W. C.

390. Operating Practices to Prolong Flow. B. Mills. *Oil Weekly*, 4.2.35, **76** (8), 28.—Remedial work carried out in the Hobbs, New Mexico, Field, has been effective in checking decline in the bottom-hole pressure. A gradual reduction in the average gas–oil ratio and shutting off of upper water in a number of wells has resulted in a gradual increase in bottom-hole pressure.

Formation packers for reducing gas–oil ratio or for shutting off water have been run with remarkable success.

Acid treatment has proved effective, the potential of the first well treated having been increased from 2981 brl. to more than 14,000 brl. daily.

Only a few wells in this field have failed to flow initially, and no wells needed to be pumped that did not show water. Three-in. tubing is used in most wells for the flow string. L. V. W. C.

391. Effect of Verticality on Spacing of Wells. Lt.-Col. H. C. H. Hickling. *Oil & Gas J.*, 24.1.35, **33** (36), 17.—The verticality of oil wells is receiving much more attention than formerly because of the beneficial results being obtained. One factor exceeds all others in importance in obtaining verticality by the rotary system of drilling, and that is fast drilling with excessive weight on the bit. Where regulations are in existence enforcing a given well spacing, verticality is essential if the field is to be drained efficiently, and if these regulations prohibit drilling within 150 ft. of a boundary the necessity for uncontrolled drilling does not exist.

The author explains that it is futile to attempt to reduce costs by increasing drilling speed, since only 10% of the driller's time is spent on drilling, and but 4% of the total costs are affected by the speed at which the well is drilled.

Gravity should be permitted to assist in the drilling of a vertical hole. The weight on the bit should be concentrated close to the cutting edge, so that the point where the drill-pipe passes from tension to compression should be placed as low as possible. Below this point the drill-pipe should be rigid, but above it can be as flexible and as small as is consistent with the load to be supported, the power it has to convey, and the fluid it has to pass.

When light bits and drill-collars are used, the point of contact of tension and compression will tend to rise high up the stem, which, being flexible, will bend and start a deviation. If the weight is concentrated as close as possible to the cutting edge, the horizontal component tending to bring the bit back to the vertical is strengthened.

Other practical means for controlling verticality are indicated. L. V. W. C.

392. Patents on Drilling Apparatus. R. F. Parks. U.S.P. 1,985,327, 25.12.34. Oil saver.

P. J. M. T. Allard. U.S.P. 1,985,710, 25.12.34. Apparatus for the boring of wells.

A. Baynton. U.S.P. 1,985,973, 1.1.35. Flowing device for wells.

P. J. M. T. Allard. U.S.P. 1,986,095, 1.1.35. Apparatus for drilling oil wells and the like.

W. J. McLaughlin, H. N. Herrick, and R. G. Wedemeyer. U.S.P. 1,987,696, 15.1.35. Core-orienting and well-surveying device.

J. H. Howard and J. C. Wright. U.S.P. 1,987,853, 15.1.35. Core catching device.

J. C. Wright. U.S.P. 1,987,886, 15.1.35. Rotary core drill.

W. T. Wills. U.S.P. 1,987,919, 15.1.35. Means for setting tubing string while packer is being set.

A. F. Spengler. U.S.P. 1,988,023, 15.1.35. Rock bit and reamer.

F. A. Reed. U.S.P. 1,988,397, 15.1.35. Well packer.

J. Bigg. U.S.P. 1,988,442, 22.1.35. Oil well casing head.

T. L. Lynch, H. L. Rilling, and H. A. Redfield. U.S.P. 1,988,741, 22.1.35. Inclination indicating device for oil wells.

L. Dillon. U.S.P. 1,988,785, 22.1.35. Apparatus for counting casing couplings.

W. Franklin. U.S.P. 1,988,829, 22.1.35. Rope socket.

G. E. Behnke. U.S.P. 1,989,260 and 1,989,261, 29.1.35. Roller bit.

J. A. Kammerdiner. U.S.P. 1,989,280, 29.1.35. Fluid catch rotary jar.

C. J. Broussard. U.S.P. 1,989,679, 5.2.35. Multiple clamp casing-head control.

J. S. Beck. U.S.P. 1,989,906 and 1,989,907, 5.2.35. Rotary jar and safety coupling.

G. G. Harrington. U.S.P. 1,989,982, 5.2.35. Core drill.

J. W. Sperry. U.S.P. 1,990,007, 5.2.35. Rotary rock bit.

J. H. Clark and H. N. Marsh. U.S.P. 1,991,658, 19.2.35. Method of measuring bottom-hole pressures by maintaining a solid body in rapid vibration in a closed case immersed to a given depth in the well. The speed of vibration is varied in response to variations in the pressure exerted by the fluid in the well. An electrical circuit is broken by the vibrations which produces electrical impulses at the surface, the frequencies of the impulses being measured at the surface.

L. C. Black. U.S.P. 1,992,350, 26.2.35. Rock drill.

E. E. Stevenson. U.S.P. 1,992,402, 26.2.35. Solid plunger liner pump.

E. L. Halliburton. U.S.P. 1,992,424, 26.2.35. Method of regulating flow of oil and gas from tubed wells by preventing free fluid flow between tubing and casing and forming a pressure storage zone to the annular space between tubing and casing. Flow takes place into this zone, and is controlled through a restriction in the tubing causing increased velocity.

W. F. McMahan. U.S.P. 1,992,436, 26.2.35. Oil well pump.

J. J. Santiago. U.S.P. 1,992,546, 26.2.35. Well scraper and reamer.

C. E. Records. U.S.P. 1,992,718, 26.2.35. Well screen.

A. L. Durham. U.S.P. 1,992,743, 26.2.35. Telescopic pitman.

J. C. Fortune. U.S.P. 1,992,746, 26.2.35. Hydraulic control for rotary drills.

National Supply Corporation. E.P. 380,487, 12.3.31. Rotary swivel.

A. B. Thompson. E.P. 382,348, 19.8.31. Coring tool.

J. A. A. Mekel and W. F. C. Baars. E.P. 382,792, 7.12.31. Boring earth by the application of heat.

J. Cuthill and Oil Well Engineering Co., Ltd. E.P. 383,703, 30.9.31. Rotary well-drilling apparatus with hydraulic or other fluid pressure feeding device.

National Supply Corporation. E.P. 384,329. Rotary swivel.

National Supply Corporation. E.P. 385,615, 24.6.31. Oil well packing head.

National Supply Corporation. E.P. 386,662, 17.4.31. Control head for wells.

Byron Jackson & Co. E.P. 389,114, 10.8.31. Tubing catchers for wells.

L. M. C. Seamark. E.P. 389,513, 12.8.31. Blow-out preventer.

National Supply Corporation. E.P. 391,957. Portable rotary draw-works.

L. M. C. Seamark. E.P. 393,637, 7.10.31. Internal blow-out preventer.

National Supply Corporation. E.P. 395,090, 11.3.32. Automatic drilling regulator.

Phillips Petroleum Co. E.P. 397,377, 21.1.33. Bottom hole choke.

J. C. Fortune. E.P. 401,490, 4.11.32. Hydraulic well-drilling plant.

W. W. Triggs. E.P. 401,721, 18.5.32. Under-reamer for oil wells.

R. C. S. Matthews and H. S. Gibson. E.P. 404,678, 12.4.32. Apparatus for obtaining samples from oil wells.

H. E. G. Rowley. E.P. 407,060, 7.7.32. Rotary draw-works.

National Supply Corporation. E.P. 409,309, 14.6.32. Portable rotary draw-works.

C. E. Reed. E.P. 418,592, 25.4.33. Roller cutter type drills.

British Thomson-Houston Co. E.P. 419,609, 18.5.33. Well-drilling plant.

L. V. W. C.

Class 400. Transportation, Storage and Distribution.

393. Reconditioning Plant for Pipe-line Companies. N. Williams. *Oil & Gas J.*, 17.1.35, **33** (35), 18.—A central cleaning yard equipped with power-driven stationary cleaning equipment or sand blasts has been established by the Houston Pipe-line Company at its Edna Station on its South-west Texas–Houston gas trunk. All pipe for reconditioning is brought to this yard, where it is thoroughly cleaned, inspected,

pit welded, primed, and made ready for use. The plant has a capacity of between 15,000 and 16,000 ft. of pipe daily.

A description of the cleaning plant and of the coating and wrapping machine is given. L. V. W. C.

394. Further Nomographic Study of Oil Pipe-line Design. L. V. W. Clark, R. Fallah, and A. W. Nash. *J.I.P.T.*, 1935, **21**, 120–124.—A description and explanation of a simpler form of nomograph previously published by the authors, and which, in addition to permitting calculations of diameter and pressure drop, permits the determination of B.H.P. corresponding to given diameters. G. R. N.

395. Pipe-line River Crossing. N. Williams. *Oil & Gas J.*, 31.1.35, **33** (37), 33.—A plan to overcome some of the difficulties usually met with in crossing rivers with oil pipe-lines has been tried out by the Humble Oil Co.

The plan consisted in shaping the line to the contour of the river-bed prior to placing. The first step was to make a thorough survey of the bottom of the creek, and soundings were made at intervals of 5 ft. or less.

The pipe was then laid out on the bank in position, and all connections were made and welded for the entire section. The pipe was then bent to scale to conform to the contour of the bottom and the ditch up the banks of the creek.

Coatings and pipe protection were then applied the full length of the section and checked. To protect the covering against damage by rubbing, the pipe was stripped with ordinary laths laid lengthwise along it.

The pipe was then pulled into place in the river. L. V. W. C.

396. Pipe-line Problems. A. W. Rowley. *Oil & Gas J.*, 31.1.35, **33** (37), 10.—The Stanolind Pipe-line Co.'s Line, which has been laid through the City of Hammond, Ind., has produced almost every type of pipe-line construction problem. The line is less than 7 miles long and is 14 in. in diameter. It had to be constructed under seventeen railroad crossings, fourteen public highways and across two rivers. The ground in which the line was laid was veritable quicksand.

The water in the sand was the first big problem to be overcome, as in many instances it saturated the sand from within 18 in. of the surface down to 20 ft. below the surface. Caving occurred if an attempt were made to dig a ditch in this sand and to overcome this points were used in taking the water out of the sand in the section to be ditched. These points were pieces of iron pipe closed and pointed at the bottom and perforated to permit entrance of water. A flexible hose was attached to the top of the sand point and to a suction pump. With the removal of the water from the section, ditching could proceed.

Pipe could not be strung along the right of way, and pipe yards had to be located at convenient intervals along the route. The new pipe was cleaned to remove mill scale, and was then electrically welded into the line. A priming coat, two coats of asphalt, a special wrapping asbestos felt, two further coats of asphalt, and a final coating of concrete were applied to the pipe. L. V. W. C.

397. Making Field Tests of Rubber Pipe-line Coating. F. H. Love. *Petr. Eng.*, February 1935, **6** (5), 25.—After exhaustive tests carried out over five years, the B. F. Goodrich Company is making its first field tests of rubber pipe-line coating in Texas. A length of pipe 100 ft. long has been removed from the line where the soil is known to be extremely corrosive, and an equal length of new pipe coated with rubber has taken its place.

Periodical inspections will be made, and it is hoped that at the end of two years it will be possible to determine whether the use of rubber on pipe-lines for protection against corrosion is practicable. L. V. W. C.

398. Vulcanised Rubber is Applied to Pipe-line to Combat Corrosion. L. E. Bredberg. *Oil & Gas J.*, 7.2.35, **33** (38), 14.—A new pipe-line coating is being tested out by the Lone Star Gas Co., which, if it proves successful, may cause a decided change in future pipe-line work. The main elements causing rapid deterioration of pipe-lines are: (1) electrolysis; (2) soil stress; (3) acid soil; (4) alkaline soil.

This new coating is a vulcanised rubber, and is considered as possibly effective against soil stress, and also against electrolysis.

The rubber covering is hard but resilient, and will not be affected by rot. The rubber is supplied in sheet rolls, a separator being used between the sheets to prevent them adhering to each other. The rubber is vulcanised in the field by allowing it to remain in the furnace for about 2 hrs. under a temperature of around 200° F.

L. V. W. C.

399. Mechanically Wrapped and Coated Pipe Helps Fight against Corrosion.—A. M. Rowley. *Oil & Gas J.*, 7.2.35, **33** (38), 30.—A method and machinery for coating and wrapping pipe at the pipe mills have been devised. It is expected that mechanical application of the hot bituminous coating at the mill will prevent moisture from being trapped by the primer, will give a uniform thickness of coating, and will eliminate the presence of air bubbles in the primer or in the coating.

All bitumens used in coatings possess certain recommended working temperatures.

L. V. W. C.

400. Corrosion of Gas Pipe-lines in California. J. C. Albright. *Petr. Eng.*, February 1935, **6** (5), 36.—It has been generally considered that the natural gas produced in California was free from corrosive agents, but this has now been proved to be incorrect. The amount of corrosion of pipe-lines, orifice meter plates, and other pipe-line fittings has been great enough to warrant an extensive study.

Practically all the indications of corrosion of pipe-line or fittings have been where pressures have been high, and no instance has yet been brought to light of corrosion taking place where the line pressure is less than 75 lb./per sq. in.

The determination of the sulphur content of the gas was carried out by a calorimetric method depending on the formation of a distinctive yellow precipitate of cadmium sulphide, the intensity of colour being a measurement of the hydrogen sulphide concentration. The gas is permitted to flow through filter paper which has been treated with a solution of neutral cadmium acetate while under test.

In order to obtain information regarding internal corrosion, several companies have arranged openings in the line for inserting metal strips into the gas stream for periodic inspection.

To determine the corrosive nature of the fluid travelling along the bottom of the line, the sample strip is bent slightly about an inch from the lower end before inserting through the test connection. The lower end of the strip is thus in the stream of the liquid and the remainder in the gas stream.

It has been definitely determined that if the gas to be transported through the lines were dehumidified, the reactions taking place would be mitigated.

L. V. W. C.

401. Labelling of Controls and Station Operation. J. C. Albright. *Oil Weekly*, 25.2.35, **76** (11), 41.—The General Petroleum Co.'s pipe-line station near San Fernando has several features incorporated which have assisted in its operation.

All gates, lines, and controls are clearly marked to assist in preventing inexperienced operators from making mistakes. A 10,000-barrel surge-tank, equipped with a vapour-proof roof, is provided to take the supply if the pumps are shut down for any reason. As soon as the pumps commence to work again, the oil collected in this tank is pumped through the line.

The exhaust steam from the compound-type engine is transferred to a tube and shell oil heater, where the oil temperature is raised from 84° F. to 104° F. After passing through the heater, the condensate is led back to the boiler-feed hot well, where it is pumped to the boiler-room and used in heating the feed. L. V. W. C.

402. Flow of Fluids in Pipes. L. M. Van Der Pyl. *Instruments*, 1935, **8**, 1.—Knowledge on this subject is reviewed and summarised. Velocity distribution across the diameter of a pipe in turbulent flow is shown graphically. The question of roughness is also considered, and the friction factor curves and table for roughness relation proposed by Pigott are reproduced. The merits and demerits of formulæ such as the Hazen–Williams formula for water and Weymouth's for gases are discussed, and it is shown that both formulæ decrease the friction factor as the pipe diameter increases, thus allowing for decreased roughness in large pipes. P. D.

Class 500. Properties and their Determination.

403. Pressure–Volume–Temperature Relations for Fractions of an Oil. R. B. Dow and M. R. Fenske. *Ind. Eng. Chem.*, 1935, **27**, 165.—A light mineral oil from a mid-continent source was fractionated under vacuum and the physical properties of the cuts were determined at atmospheric pressure and at high pressures up to 4000 kg./sq. cm. The pressure–volume–temperature relations for twelve samples are given in a table. When the figures are plotted so as to show the variation of one of the properties (for instance, specific volume) with the number of the cut, an irregular line is obtained, particularly when considering the properties at very high pressure. The average thermal expansion over the range 40–75° C. was found to vary greatly with pressure. P. D.

404. Phase Equilibria in Hydrocarbon Systems. VII. Physical and Thermal Properties of a Crude Oil. B. H. Sage, W. N. Lacey, and J. G. Schaafsma. *Ind. Eng. Chem.*, 1935, **27**, 162.—Data are presented which cover the values for heat content, entropy, and volume for a crude oil over the range 60–220° F. and up to 3000 lb./per sq. in. The apparatus has been previously described (*Ind. Eng. Chem.*, 1934, **26**, 1218). The oil investigated was Californian crude, which was taken from a vent tank at about 120° F. and at slightly less than atmospheric pressure. Thus only the condensed liquid region could be investigated in the experiments, and the work is a preliminary study before embarking on an intensive study of oil–gas mixtures such as are usually found in reservoirs.

The data are presented graphically and in tabular form, and there is a discussion of the application of the data to flow problems. P. D.

405. Molecular Weight of Cracked Distillates. O. FitzSimons and E. W. Thiele. *Ind Eng. Chem., Anal.*, 1935, **7**, 11.—The method used was the cryoscopic with modified apparatus consisting of a Dewar flask surrounded by ice and water mixture. Inside the flask is the tube containing a Beckmann thermometer and mechanically operated stirrer. The formula used was

$$M = (F - d)w/dS$$

where M = apparent molecular weight; F = cryoscopic constant of the solvent; d = freezing-point depression in ° C.; w = wt. of solute added; S = moles of solvent. F was calculated from recent data of Parks and Huffman using the formula: $F = R\theta^2/\Delta H\theta$, where R = gas constant; θ = freezing-point of solvent, degrees Kelvin; $\Delta H\theta$ = heat of solidification of the solvent at the freezing-point. Benzene was used as solvent in the majority of determinations, nitrobenzene for light cuts which might contain benzene or *cyclo*hexane, and *cyclo*hexane on samples which contained wax. When computed by the above means, it was found that the apparent molecular weight tended to increase with increasing concentration, and the exact value is found by plotting the concentration against apparent molecular weight and extrapolating to zero concentration.

It was found that the formula $M = (F - 2d)w/dS$ gave extremely constant values for molecular weight regardless of the concentration. This latter method is, however, only experimental, and to be used only to benzene and *cyclo*hexane. Correlation of other physical properties are given. R. E. D.

406. Extinction Coefficients of Mineral Lubricating Oils. R. Koetschau, *Brenn.-Chem.*, 1934, **15**, 441–449.—The Zeiss–Pulfrich photometer allows the colour value of a liquid to be determined for eight spectral colours of known mean wave-length, by means of light filters ranging from red to violet. The set up permits of the testing of liquid layers varying from 1 mm. to 50 cm. length, and is therefore suitable for oils of diverse colour intensity.

The instrument operates by the equal and simultaneous illumination of two containers, the one containing the oil under test and the other a reference liquid, *e.g.* water. Looking through the eye-piece, the field of view is seen to be divided by a fine line, and rotation of an attached knob serves to reduce the intensity of the brighter portion to that of the lesser. A reading of a scale graduated on the knob periphery gives the percentage light transmission for the wave-length band of the colour filter used.

The logarithm of per cent. transmitted and the layer thickness are proportional, and the extinction coefficient k is the negative logarithm of the percentage transmission referred to as 1 cm. layer, which in recent forms of the instrument may also be read off on the periphery scale mentioned above.

For example, if transmission = 20%, log 0·20 = 0·30 − 1 = − 0·70, the negative log being + 0·70. If the liquid layer used be other than 1 cm., the value calculated as above is divided by the layer length actually employed in order to obtain the coefficient k.

By means of the eight colour filters, eight values are determined, yielding an extinction curve, the form of which is independent of the layer thickness employed, although the absolute values of K vary. By taking log logs, curves are obtained which are independent of concentration and layer thickness, being parallel for solutions of varying concentration. These are termed by the author absolute colour curves.

The application of the procedure to refining and utilisation problems is described.

B. C. A.

407. Spontaneous Ignition of Petroleum Fractions. P. J. Wiezevich, J. M. Whitely, and L. B. Turner, *Ind. Eng. Chem.*, 1935, **27**, 152.—The apparatus used for the experiments was a gas-heated Thompson bomb and a modified Moore apparatus. Open heated plates were tried initially, but up to 950° F. none of the oils used could be made to ignite spontaneously. It was found that with closed-chamber apparatus, it was necessary to control the conditions of operation in order to avoid widely varying results. Variations in drop size caused variations up to 100° F., and differences in the amount of air introduced after the oil were responsible for variations up to 50° F. With oxygen under pressure, the S.I.T. occurred so rapidly that it resulted in a detonation. S.I.T. effect is catalysed by iron and aided by dispersion of the oil over a material having a large surface area. Nitrogen retards detonation tendencies.

On correlating average boiling-point and gravity (A.P.I.) with S.I.T., it is seen that the latter falls with increase in boiling-point to about 600° F. in the kerosine range, after which a sudden rise to 800° F. S.I.T. takes place in the lubricating oil range. Depending on the origin of the fractions, with increase in gravity, the S.I.T. falls sharply to a minimum and then rises slowly to a maximum. It is concluded that the determination of spontaneous ignition temperature is a relatively simple method for indicating the structure of hydrocarbons. For the same number of carbon atoms, the decrease in S.I.T. falls in the order: aromatics, alkylated aromatics, naphthenes, alkylated naphthenes, straight-chain paraffins, branched-chain paraffins, and unsaturated aliphatics. It is improbable that any correlation is possible between S.I.T. and the anti-knock effect of hydrocarbons, as knock suppression is dependent more on the compactness of the molecule than on specific structural classifications.

W. H. T.

408. Temperature Correction for the Calometric Determination of Heats of Combustion. W. Schulter and R. Nübel. *Brenn.-Chem.*, 1934, **15**, 466–469.—The development of corrections for heat loss in calorimetric determination is discussed and two new formulæ are presented.

B. C. A.

409. Routine High-vacuum Distillation of Oils. K. I. Watson and C. Wirth. *Ind. Eng. Chem., Anal.*, **7**, 72.—A method, capable of standardization, is described for assessing distillation characteristics of heavier oils. It consists of a high vacuum Engler distillation apparatus comprising a round-bottom flask inside which are four sharp points the object of which is to puncture large liquid films. The flask is connected to condenser, and this in turn to graduated receiver. All joints are ground glass and interchangeable. To the vapour outlet of the flask is attached a long glass thermometer jacket through which the thermometer passes and is sealed in. A circuit is completed to the distillation apparatus by means of a McLeod gauge.

Details of manipulation are given together with a nomographic chart (derived from Brown and Coats chart) for boiling-point conversion.

R. E. D.

410. Determination of the Degree of Purity of Liquid Substances and Azeotropic Mixtures. W. Swietoslawski. *J. Phys. Chem.*, 1934, **38**, 1169.—A standardized type of ebullioscope is described, and it is proposed to characterise the purity of a substance by the difference in the boiling-point of the liquid and the temperature of condensation

as measured in the instrument. Five degrees of purity are proposed, in which the differential temperature ranges are 1·0–0·10° C., 0·10–0·05° C., 0·05–0·02° C., 0·02–0·005° C., and less than 0·005° C.

The effect of simple and fractional distillation on the purity of a sample of *iso*propyl alcohol is discussed. P. D.

411. Theoretical Considerations of the Engler–Ubbelohde Boiling-point Curve. E. L. Lederer. *Petr. Zeit.*, 6.2.35, **31** (6), 1–12.—That the distillation analyses of mixtures such as cracked spirits is insufficient to give correct information regarding the distribution of the components has been shown by a discussion of the differential coefficients of the log, curve. This is now explained mathematically and graphically for limiting cases using pure compounds and mixtures of those compounds which have been isolated from motor fuels. It has been found possible by this means to differentiate between straight-run and cracked fuels and between oils of different geological ages.

With cracked distillates there is frequently a concentration of one type of component near one of the mean component points, and in this case the mean boiling-point has only a theoretical significance.

Hydrogenation causes no appreciable change in the boiling-point curve, but cracking and topping equations are liable to give sudden changes in the curve illustrating the distribution of components.

The work is elaborated by tables of data and mathematical examples. W. S. E. C.

412. Viscosity of Mixtures of Liquids at High Pressures. R. B. Dow. *Physics*, 1935, **6**, 71.—The effects of pressure and temperature change on the viscosity of organic binary mixtures have been investigated by methods developed and used by Bridgman. Six mixtures have been examined over the entire concentration range at two temperatures, 30° C. and 75° C., and at pressures extending to 12,000 kg./cm.². The isobaric log viscosity–concentration curves for *n*-hexane–carbon disulphide, and *n*-hexane–*n*-decane mixtures are linear at both temperatures, indicating that these mixtures obey Arrhenius' empirical equation for the viscosity of a binary mixture. It is believed that a comparatively simple type of interlocking among molecules occurs in these mixtures due to the effectively linear structure of the molecules and the absence of non-uniform molecular fields such as would cause some sort of association. For the remaining mixtures: *n*-hexane–diethyl ether, *n*-hexane–chlorobenzene, *n*-pentane–benzene, and eugenol–carbon disulphide, the corresponding viscosity isobars are more complex: irregularities occur in certain regions of concentration which vary with temperature and pressure. In these latter mixtures the interlocking at high pressures is complicated by the structural differences of the component molecules and their effects. The viscosity of *n*-decane as a function of pressure and temperature has also been investigated. P. D.

413. Ostwald Viscometers for Petroleum Oils. E. Willihnganz. *Physics*, 1934, **6**, 61.—The conditions influencing the design of viscometers of the Ostwald type have been reviewed by Barr. In the light of his criticism of the normal type of Ostwald viscosity pipette, two instruments were designed for determining the viscosity of mineral oil which were free from the objections which are levelled at the normal type. These viscometers are fully described, together with the tests carried out in calibrating them. An equation is given for determining the viscometer constant at temperatures other than the temperature of calibration.

It was found that when a working volume of 2·5 ml. is used, the viscometers designed for viscous oils do not need a drainage correction, while the viscometer designed for the lighter oils does. This rather surprising finding has been checked with a large number of viscometers and no exception found. P. D.

414. Evaluation of Oils for the Manufacture of Carburetted Water Gas. P. J. Herkus and A. H. White. *Gas J.*, 1935, **209**, 196–198.—The possibility of hydrogen content as a guide to carburetting value of gas oils has been investigated, and a curve given shows there is good correlation between % hydrogen and pounds of oil per 1000 cu. ft. gas of 530 B.Th.U. Carburetting tests on *cyclo*hexane and benzene have been included on this curve, and these show good agreement with the other results. The suitability of tars for carburetting purposes is discussed, and from their content of available

hydrogen (*i.e.* surplus hydrogen after all the oxygen in the compound has been calculated as being in combination as water) they are considered to be of little value.

The carburetting value of absolute ethyl alcohol has been investigated, but the gas formed has a heating value of only 498 B.Th.U., which is useless for enriching blue gas.

Data are given showing that a gas oil with 14% hydrogen is worth twice as much per lb. as another with 10% hydrogen, and, further, that the carburetting value of oils falls off rapidly when the hydrogen content is below 9%. W. A. W.

415. Conversion of Methane and Petroleum Hydrocarbons with Steam. C. Cândea and J. Kühn. *Bull. Sci. de l'Ecole Polyt. Timisoara*, 1934, **5**, 225–232.—The authors have examined the products from the reactions which occur when natural gas (96·4% methane), a kerosine, and a distillation residue from Păcura crude, each in the presence of steam, are separately passed over catalysts at temperatures, from 650 to 1000° C. Optimum conditions with the natural gas gave a product containing about 20% carbon monoxide and 70% hydrogen. With the kerosine, the best product contained 30% hydrogen and 70% carbon monoxide. Between 800 and 900° C. a good illuminating gas was produced from the residuum, which gas could be advantageously used in a producer gas engine. W. E. J. B.

416. Causes of Detonation in Petrol and Diesel Engines. G. D. Boerlage and W. J. D. Van Dyck. *J.I.P.T.*, 1935, **21**, 40–52.—An abridged version of a paper presented to a joint meeting of various societies on some views relating to the combustion phenomena of petrol and Diesel engines. G. R. N.

417. Detn. of Sulphur by the Lamp Method. N. A. Orlov and A. S. Brown. *For. Petr. Techn.*, 1934, **2**, 302. The authors substitute potassium dichromate for hydrogen peroxide in the Schulz method, the reaction being as follows: $K_2Cr_2O_7 + 8HCl = 2KCl + 2CrCl_3 + 3H_2SO_4$ and H_2O. G. R. N.

418. Determination of the Aromatic Content in Cracked Gasolines. J. C. Vlugter. *J.I.P.T.*, 1935, **21**, 36–39.—Describes a method of determining the aromatic content of cracked gasolines by first selectively hydrogenating the olefines, then using concentrated sulphuric acid to determine the aromatics in the usual way. G. R. N.

419. Oxidation of Benzine. C. Cândea and N. Cristodulo. *Bull. Sci. l'Ecole Polyt. Timisoara*, 1934, **5**, 233–243.—The formation of oxidation products in benzine from Rumanian Moreni crude oil has been studied, together with the corresponding products formed in mixtures of different hydrocarbons. 50 mls. of spirit were passed with air through a tube at 320° C. over a period of 2 hrs. The product—both condensed liquid and uncondensable gases—was examined for peroxides, aldehydes, acids, etc. Aldehydes were determined by the reaction with iodine and caustic soda, while the organic acids were estimated by titration with alkali. Oxidation experiments were carried out both on the straight benzine and on the latter freed from aromatic and unsaturated hydrocarbons. It is concluded that aromatics usually inhibit the formation of peroxides, but that cyclic hydrocarbons, *e.g. cyclo*hexane, promote the production of peroxides.

The inhibitory action of aromatics was confirmed by tests carried out with benzole and benzole–benzine mixtures, benzole being very difficult to oxidise under the conditions of the experiments.

Experiments with pinene and mixtures of this material with benzine show that unsaturated hydrocarbons promote the formation of peroxides and resins. C. C.

420. Determination of Methane by Catalytic Oxidation. I. F. Walker and B. E. Christenssen. *Ind. Eng. Chem., Anal.*, 1935, **7**, 9.—The apparatus used was a Burrell Bureau of Mines gas analysis apparatus. Two types of combustion tubes were used, the simple consisting of the catalyst chamber, the copper oxide area being replaced by capillary tubing; and the compound in which one side contained the copper oxide and the other the catalyst. The catalyst was made by evaporation and thermal decomposition of a solution containing copper nitrate and cobalt nitrate on unglazed porcelain particles. Figures are given to show:—

1. That passage of gas at rate of 20–25 c.c. per minute over the catalyst gives a 97% efficiency of oxidation with one passage;

2. That at concentrations of one part of methane to three parts of oxygen high efficiencies are maintained;

3. That after eighty determinations the efficiency of the catalyst had not changed;

4. That passage twice over the catalyst with a flushing at 550° C. will ensure complete oxidation;

5. The method is rapid and safe and gives complete agreement with the slow combustion method at all concentrations of methane. R. E. D.

421. Estimation of Unsaturation in Diphatic Hydrocarbons by Bromide–Bromate Titration. S. P. Mulliken and R. L. Wakeman. *Ind. Eng. Chem., Anal.*, 1935, **7**, 59.—Figures are given to show that the bromide–bromate titration can be used with a fair degree of accuracy for titration of alkenes, and to determine the number of double bonds present in *cyclo*alkenes and in alkadienes. Quantitative estimation is, however, less accurate. R. E. D.

422. Physical Constants of Dimethylacetylene. G. B. Heisig and H. M. Davis. *J.A.C.S.*, 1935, **57**, 339–340.—This hydrocarbon was prepared by the action of methyl iodide on the sodium salt of methylacetylene. Constants: liquid density 0° C., 0·715, B.P. 27·2° C., m.-p. −32·5° C. W. E. J. B.

423. Apparatus for Control of Pressure in Distillation. G. W. Jacobs. *Ind. Eng. Chem., Anal.*, **7**, 70.—A modified vacuum control is described which is claimed to maintain the required vacuum within $\pm$ 0·015 mm. of mercury. It consists of a solenoid valve controlling a capillary leak. This in turn is controlled by automatic activation of the solenoid by means of the Hershberg and Hunter's sulphuric acid manostat. No relays are employed. R. E. D.

424. Vacuum Regulator. C. W. McConnell. *Ind. Eng. Chem., Anal.*, **7**, 4.—What is claimed to be a flexible vacuum regulator consists of an intermittent leak which is controlled by a rubber cushion attached to a spring which acts as the armature for a magnet the circuit of which is opened and closed by movement of mercury in one limb of a mercury manometer. R. E. D.

425. Confining Liquids for Gas Analysis. K. A. Kobe and J. S. Williams. *Ind. Eng. Chem., Anal.*, 1935, **7**, 37.—A description of apparatus used for investigating solubility of carbon dioxide in confining solutions is given. The work was carried out to determine the most practical confining solution and a 20% by weight sodium sulphate and 5% by volume sulphuric acid solution is recommended for technical gas analysis equipment. The acidification is necessary to prevent the solution from becoming alkaline during use. R. E. D.

426. Use of Physical Constants in the Determination of the Composition of Motor Fuels. M. Marder. *Oel u. Kohle*, 1935, **11**, 1–5, 41–43.—(1) *Density* (*d*) *and Refractive Index* (*n*). Both these constants increase according to the class of hydrocarbon from paraffin, olefine, naphthene to aromatic in the order given. The relations between d. and mol. wt. and n. and mol. wt. are shown by curves.

A method is given for determining the composition of a mixture of hydrocarbons from measurements of d. and n. Olefines are first removed, *e.g.* by mercuric acetate, then d. and n. are measured before and after removing the aromatics from the residue. The values obtained are plotted against the mol. wt. on a diagram on which the theoretical aromatic curve has also been plotted. The volume % of aromatic hydrocarbon is given by $\frac{a}{A}$. 100 where "a" and "A" = the distances in cm. from the aromatic curve of the value of the constant before and after sulphonation respectively. For gasolines the average mol. wt. is taken as 100, but this should be determined for more accurate work.

Both paraffins and naphthenes show a considerable rise in d. and n. with increasing mol. wt. The gasoline is therefore split up into three or four fractions, and d., n., and mol. wt. determinations are made on each fraction. The paraffin and naphthene content is then calculated from a formula similar to the one given above.

(2) *Surface Tension.* Differences in surface tension of the various types of hydrocarbons are too small for this property to be used for quantitative estimations.

(3) The use of a general physical expression combining such constants as molecular refraction, d., n., and mol. wt. is discussed, particularly the conception of the molecular parachor :— $P = \sigma^{\frac{1}{4}} \cdot \frac{M}{D}$, where P = mol. parachor, M = mol. wt., D = density at $t°$ and σ = surface tension at $t°$. The parachor can be calculated from the chemical structure of the mol., atoms, double and treble bonds, rings, etc., all contributing. The calculated parachors for the four types of hydrocarbons have been plotted against mol. wt., and form a series of steep parallel lines. The specific parachor P/mol. wt., has also been plotted against mol. wt. This conception is not of much practical value in estimating the composition of hydrocarbon mixtures, since the differences involved are so small. It has value, however, for determining the average number of double bonds in the separated unsaturateds, and also for determining the nature of the separated aromatics, *e.g.*, whether di- or tetra-hydro, etc., by measuring the parachor before and after acid treatment. In each case the parachor is plotted on the diagram for the pure unsaturateds and aromatics, respectively.

A further application of the parachor determination consists in an approximate determination of the average number of side-chains in the paraffin fraction and the average number of C atoms in the ring of the naphthene fraction. Since, however, no satisfactory method is available for separating naphthenes and paraffins, the calculation is rather complicated. *cyclo*Hexane is dehydrogenated by spongy palladium at 200°, and the aromatics formed are removed by H_2SO_4; the *cyclo*pentane remaining is estimated by the aniline point or refractometric method. By determining the parachor of the residual mixture and by making due allowance for the *cyclo*pentane, the parachor of the paraffins can be obtained. It is hoped to develop this method.
C. C.

427. Mineral Content of Petroleum. E. Longobardi. *J.I.P.T.*, 1935, **21**, 132–134. —A précis of a paper published in *Rept. Argentine Chem. Soc.* (1934, **107** (1), 5–18), on the presence of vanadium in Argentine petroleum and on the inorganic constituents of crude petroleum. G. R. N.

428. Composition of Polish Gasolines. Z. Lahocinski and Z. Tomasik. *Przem. Chem.*, 1934 (10–12), 473–478.—Gasolines and propane–butane mixtures produced in Poland have been analysed in the Podbielniak apparatus, and the results are given. Special attention has been paid to the importance of stabilization from the points of view of behaviour in the engine and losses in storage. E. F.

429. Chlorinated Waxes. R. Strauss. *Oel und Kohle*, 1935, **11**, 83–85.—The article opens with a review of the scant literature on the subject of chlorine compounds prepared from paraffin wax, and proceeds to a comparison of the products obtained from soft and from hard waxes. For the same percentages of chlorine the products from soft wax have lower specific gravities, viscosities, and flash-points than those from hard waxes. For both classes of compounds all these properties increase with rising amounts of chlorine. Yoshio Tanaka is quoted as being of the opinion that the products are eutectic mixtures of isomers and condensation products. The chlorinated waxes are miscible in all proportions with castor oil, and promote the solubility of castor oil in mineral oils. The chlorine atoms in the compounds can be substituted by hydroxyl or amino-groups by interaction with alkalis, ammonia, or ammonium carbonate. Similarly, esters and sulphonated products are readily formed, the latter having a pasty consistency. J. L. T.

430. Effect of Continued Heating on Asphalts. A. W. Sikes and C. H. Corey. *Ind. Eng. Chem.*, 1935, **27**, 192.—For the purpose of the investigation, 5-gallon samples of the asphaltic materials in cubical steel containers were heated without stirring in a thermostatically controlled, electrically heated oven. Samples were taken every 10 days, and examined immediately after cooling. The materials tested were a steam-reduced asphalt and asphalt-rosin rosin-oil mixtures. Under the experimental conditions adopted, it was found that viscosity and penetration changed rapidly for the first few days or weeks of heating and that flash-point was the least affected. Softening-point changed regularly throughout the tests and ductility decreased markedly. There was a general decrease in acidity finally reaching a constant figure

after an initial increase. This may be explained by the continuous volatilisation of the acidic materials and their escape from the oven throughout the duration of the test. W. H. T.

431. Rheological Properties of Asphalt. II. Discussion of Penetration–Viscosity Relationships. *Physics*, 1935, **6**, 1, 58.—Saal and Koens (*J.I.P.T.*, 1933, **19**, 176) measured the viscosity and penetration of two bitumens at various temperatures, and expressed the relation between the two properties by means of an equation. In the present paper the viscosity–penetration relation over the range 15–40° C. was examined for five bitumens. It was found that a sinuous line was obtained if log penetration was plotted against log viscosity, and that the addition of a sine-term of varying amplitude or frequency would not fit the curves really well to the points. Saal and Koens' results also show the sinuous line, and the authors conclude that a simple equation such as that used by Saal and Koens can at best only be a rough approximation.

The way in which the penetration–viscosity relation alters due to processing of the asphalt was examined by determining the constants at 25° C. for asphalts fluxed to various consistencies. A sinuous curve was obtained in this case also. P. D.

432. Synthetic Hydrocarbons from Water-Gas. N. A. Klyukvin and Y. N. Volnov. *Khim. Tverdogo Topliva*, 1933, **4**, 355–362.—According to experiments discussed the catalysts Ni–Th, Ni–Th–Hg, and Ni–Mg, are best for production of gasoline from carbon monoxide and hydrogen yielding under the most favourable conditions 0·1 gm. gasoline from 1 litre of gas passed, *i.e.* 30–40% on the converted CO, this yield being raised to 98–100% on recycling. By the proper selection of the catalysts and the process conditions a product high in unsaturates may be obtained. Twenty-six references are appended. For. Petr. Techn.

433. Methanol Synthesis from Water-Gas. B. N. Dolgov and A. Z. Karpov. *For. Petr. Techn.*, 1934, **2**, 262.—The synthesis was carried out with technical water-gas plus sufficient hydrogen to maintain the necessary CO/H_2 ratio in the presence of a $4ZnO,Cr_2O_3$ catalyst at a constant pressure of 250 atm. and 370° C. The product was contaminated with iron carbonyl, which precipitated out under the influence of air. The degree of conversion per cycle was 9%, making a total yield of 63%. G. R. N.

434. Methanol Synthesis from Water-Gas under Pressure. B. N. Dolgov, A. Z. Karpov, and M. V. Veltistova. *For. Petr. Techn.*, 1934, **2**, 291.—The $4ZnO,Cr_2O_3$ catalyst used in 186 experiments still retained its activity and contained 78·1% ZnO, 18·3% Cr_2O_3, 0·3% Fe_2O_3, and 2·0% S, and 1·1% containing $ZnCO_3$, $ZnSO_4$, etc. It was found that a rate of 350 litres/hr. of gas gave a volume velocity of 35,600, a contact time of 10·4 sec., and a yield of 750 gm. methanol per hr. The regular and frequent discharge of methanol from the apparatus increased the yield. Use of the water-gas alone gave first a notable decrease in catalyst activity, but later increased, due to increase in hydrogen through conversion of the carbon monoxide. A detailed analysis of the crude methanol showed it contained small amounts of acetic acid, ethyl acetate, acetaldehyde, acetone allyl alcohol, iron carbonyl, sulphur, and water. G. R. N.

435. Methanol Synthesis from Carbon Dioxide and Hydrogen. B. N. Dolgov and M. N. Karpinskii. *For. Petr. Techn.*, 1934, **2**, 265.—The gas mixture used was prepared by mixing CO_2 and H_2, compressing it, and storing it in steel bottles. The experiments were carried out at decreasing pressure and the activity of catalysts examined at 226–400° C. The reaction proceeded in two stages: (1) $CO_2 + H_2 \rightarrow CO + H_2O$ and (2) $CO + 2H_2 \rightarrow CH_3OH$. The velocities of both reactions were different, and depended on ratio of gases, volume velocity, etc. It was found that the maximum reaction temp. was at 300–325° C., *i.e.* 75° C. below the corresponding temperature when using CO and H_2. The following catalysts were used in various combinations: MgO, Fe_2O_3, ZnO, ThO_2, V_2O_5, Ce_2O_3, CuO, Ni_2O_3, CdO, MnO, and Cr_2O_3. Methanol yields of 50–51·5% were obtained using ZnO + 4·5% CdO + 5% Fe_2O_3 and ZnO + 2% Fe_2O_3 + 1% CuO. Working under a constant pressure of 200–210 atm. at 325° C. with ZnO + 5% CdO as catalyst 63% by weight methanol was obtained. The crude methanol contained traces of olefines and acetaldehyde and 0·05–0·06% acetic acid. The gas mixture contained 1 vol. CO_2 per 3–3·5 vols. H_2 together with 0·2–0·8% CO and 0·4–3·0% N_2. G. R. N.

436. Methanol Synthesis : Influence of Activators. B. N. Dolgov and M. N. Karpinskii. *For. Petr. Techn.*, 1934, **2**, 264.—The following promoters were used in admixture with the zinc chromate ($4ZnO,Cr_2O_3$) catalyst : W, V, Th, U, Ce, La, Ta, and Zr. The highest methanol yields under decreasing pressure in each case were obtained with 1% of the activators, ThO_2, ZrO_2, and TaO_2. G. R. N.

437. Formaldehyde in the Methanol Synthesis from Water-Gas. B. N. Dolgov and E. M. Bocharova. *For. Petr. Techn.*, 1934, **2**, 264.—When water-gas is passed over porous surfaces (glass, porcelain, carbon) minute amounts of formaldehyde are obtained. The only satisfactory metallic catalysts are silver and copper. Catalysts prepared from compressed copper discs placed close together give a formaldehyde yield of 42%. A catalyst containing copper oxide plus activator gave 21–42% formaldehyde. The best results were obtained using thorium and uranium catalysts, which give 42%. G. R. N.

438. Methanol Synthesis from Carbon Monoxide and Hydrogen. B. N. Dolgov. *For. Petr. Techn.*, 1934, **2**, 261.—The synthesis was carried out in a copper-lined steel bomb at 350–400° C. and 100–150 atm. (cold) using a mixture of Kahlbaum carbon monoxide and hydrogen gas containing 97·2% hydrogen. The catalysts used were zinc chromates, and the tri-component catalysts $Cu_{10}Zn_{43}Cr_8$ and $Cu_{36}Zn_{40}Bi_{16}$. The yield of methanol was 86–87% and 75% at 360° C. and 400° C., respectively. The product contained 89–92% methanol, 2–4% unsaturates, 0·05–0·2% aldehydes and ketones, and 9–4% water and other substances. G. R. N.

439. Ethanol Synthesis. N. A. Klyukvin, Y. N. Volnov, and M. N. Karpinskii. *For. Petr. Techn.*, 1934, **2**, 265.—The synthesis was carried out by heating a gas of composition 33·4% CO, 66·2% H_2, and 0·4% CO_2 to 320–330° C., maintaining a pressure of 120 atm. and using ZnO : CoO (3 : 1) as catalyst. A 39% yield of ethanol was obtained, together with other alcohols ranging from methyl to amyl. G. R. N.

Class 600. Refining and Refineries.

440. Determination of Plate Efficiency in Fractionating Columns for Complex Mixtures. A. J. V. Underwood. *J.I.P.T.*, 1935, **21**, 125–131.—A paper read at a joint meeting with the Institution of Chemical Engineers giving a mathematical treatment of the efficiency of an individual plate in a fractionating column for the three possible cases, which indicates the method of procedure to determine this efficiency in practice. G. R. N.

441. Practical Testing of a Continuous Petroleum Still. A. H. Goodliffe. *J.I.P.T.*, 1935, **21**, 53–74.—An abridged version of a paper presented at a joint meeting with the Inst. Chem. Eng., giving a description of a pipe-still unit, the log of its operation with all balances, and calculations on plant and equipment. G. R. N.

442. Efficiency of Rectification. Anon. *Chem. Fabrik.*, 1935 (1/2), 14; *Forschung*, 1934, **5**, (5).—The efficiency of rectification and related flow of liquids is discussed. The optimum degree of enrichment obtainable on an " exchange bottom " is calculated and the " real " efficiency derived. If thorough mixing of liquid and vapour at all points is obtained, then the efficiency is at a maximum. However, when vapour and liquid move counter-currently, efficiency will increase if thorough mixing is avoided and the fluid takes a tortuous path. L. S.

443. Cracking with Aluminium Chloride. A. F. Dobryanski and N. I. Zelenin. *For. Petr. Techn.*, 1934, **2**, 293.—A kerosine distillate was treated with 15% $AlCl_3$ and gave 46·6% gasoline of sp. gr. 0·745 the yield being raised by prolonging the distillation. Various gas oils and fuel oils, straight run and cracked, were also treated. The gasoline obtained contained 2% benzene, 5·4% toluene and 5·7% xylenes. The gas contained about 94% butane, 5·7% hydrogen, and 0·3% heavier hydrocarbons. G. R. N.

444. Thermodynamics of the Hydrogenation Reactions. A. V. Frost. *Khim. Tverdogo Topliva*, 1933, **4**, 171–185.—The equilibria of the following substances reacting in the gaseous phase in accordance with the reactions given below are calculated on the basis of experimental data. (1) $C_6H_6 + 3H_2 \rightleftharpoons C_6H_{12}$; (2) $C_6H_5CH_3 + 3H_2 \rightleftharpoons C_6H_{11}CH_3$;

(3) $2C_6H_6 \rightleftharpoons C_6H_5{\cdot}C_6H_5$ and H_2; (4) C (graphite) + $2H_2 \rightleftharpoons CH_4$; (5) C (amorphous) + $2H_2 \rightleftharpoons CH_4$; (6) 2C (graphite) + $2H_2 \rightleftharpoons C_2H_4$; (7) C_2H_4 and $H_2 \rightleftharpoons C_2H_6$; (8) 2C (graphite) + $2H_2 \rightleftharpoons C_2H_6$. A bibliography of 33 references is appended.

For. Petr. Techn.

445. Destructive Catalytic Hydrogenation. I. S. Diner and M. S. Nemtzov. *For. Petr. Techn.*, 1934, **2**, 253.—The experiments were carried out with Grozny mixed base fuel oil (sp. gr. 0·906, pour-point 35° C., 10% paraffin and 18% resins) to establish the influence of the amount charged to the autoclave the velocity of agitation, the effect of the severe processing conditions, and the temperature. NiO was used as catalyst and the temperature range was 430–450° C. The energy of activation of the thermal decomposition of the mixture was found to be of the order of 38,000–79,000 cal. A detailed description and a theoretical discussion are given. G. R. N.

446. Destructive Catalytic Hydrogenation. N. S. Diner and M. S. Nemtzov. *For. Petr. Techn.*, 1934, **2**, 284.—It was found that a Ni catalyst primarily reduced and Ni as oxide charged directly to the autoclave gave identical results in high-pressure hydrogenation. Increases in the amount of catalyst up to 20% acted favourably, while processes of coke formation were discontinued for amounts of 5–8% of catalyst, the small amount of carboids on the catalyst being stabilised. Increase of partial hydrogen pressure caused stabilisation, and was reflected mainly by the degree of aromatisation of the final products. The influence of hydrogen pressure on the content of unsaturates is of a kinetic nature, and their concentration is a function of the specific velocities of the thermal decomposition and the hydrogenation. Analyses of the results suggest that the elimination of the processes of coke formation is governed by the velocity of the reaction. It is concluded that destructive hydrogenation can be carried out at a considerably lower pressure but a higher temperature, this making the operation cheaper and yielding a higher aromatisation of the final products.

G. R. N.

447. Synthetic Motor Fuels and Lubricants. M. Pier. *Chem. Z.*, 1935, **9**, 37.—In the I.G. process for the hydrogenation of coal, the first stage is carried out in the liquid phase and yields a middle oil which on further hydrogenation gives a gas oil or kerosine. Continuous reaction yields gasoline when carried out in the vapour phase in the presence of a solid catalyst. The process is shortened by the use of brown-coal tar. Another process (Fischer) consists in partial gasification and rearrangement of producer water-gas into liquid fuel. If water is formed, hydrocarbons are produced, but if water be absent, the products contain oxygen. The use of sulphur-free hydrogen is essential, and the consumption of raw material is greater than by direct hydrogenation of coal. Kerosine and lubricating oils may be produced by catalytic pressure hydrogenation, the products being of high mol. wt. and rich in hydrogen. Recently, the I.G. has been producing lubricants by dehydrogenation and polymerisation of paraffins, followed by dehydrogenation or chlorination and condensation. The products are high-molecular lubricating oils and special materials such as paraflow. The unsaturated gases from the waste gases of hydrogenation may also be condensed alone or mixed with other oils. Considerable amounts of propane and butane are formed during catalytic hydrogenation, and are useful as domestic fuel, or, when bottled, as anti-knock fuels. L. S.

448. Hydrogenation-cracking of Creosote. C. M. Cawley, C. C. Hall, and J. G. King, *J.S.C.I.*, 1935, **54**, 58T–62T.—These experiments were made on two horizontal retort tars: (I) produced at the Fuel Research Station, and (II) a corresponding commercial product. Two plants were used, capable of treating 200 ml. and 12 ml. per hour, respectively. The larger plant has been more fully described elsewhere (*Fuel Research Tech. Paper*, No. 41). Both plants were of similar design, consisting essentially of an electrically heated reaction vessel filled with a catalyst (molybdenum sulphide supported on alumina gel). Creosote and hydrogen are passed downwards through the catalyst bed at the required pressure; vapours and gas issue at the bottom, the liquid product being collected in a high-pressure receiver and the uncondensed gas in a separate apparatus. The gas throughput was controlled by means of the residual gas, while the required pressure was obtained by adjusting the hydrogen input, the reverse procedure being impracticable owing to the deterioration of the catalyst, with consequent decrease in hydrogen consumption. Using (I), the effect of

varying the conditions was studied. Increased residual gas rate, *i.e.* hydrogen/creosote ratio, reduced the rate of deterioration of the catalyst, and at the same time showed increased spirit yield up to a certain point, beyond which the amount of spirit produced became less.

Increasing the temperature gave larger spirit yields up to a certain limit, beyond which point cracking to gas was greater but spirit yield was unaffected, while the rate of deterioration of catalyst under these conditions was much increased. Increasing the throughput at high temperature showed a small reduction in % yield of spirit, an increased % of total oil with decrease of gas production; actually this means that increased throughput gives a plant-yield of almost double the amount of spirit.

Re-processing the hydrogenated creosote, boiling above 200° C., gave similar yields of spirit as the original creosote, but resulted in a high rate of deterioration of catalyst.

Experiments with (II) gave poorer results than (I), due, it is alleged, to presence of high-boiling oils in the former. The effects of increased pressure were studied in the smaller plant, larger yields of spirit being obtained accompanied by considerable reduction in the rate of deterioration of the catalyst. W. A. W.

449. Desulphurising Shale Gasoline by Hydrogenation. S. S. Nametkin and others. *For. Petr. Techn.*, 1934, **2**, 297.—Complete desulphurisation of shale gasoline was obtained by hydrogenation in the presence of 10% MoS_2 during 1 hr. at 350° C., initial H_2 pressure of 50 atm., process pressure of 80–90 atm. and charging 7% hydrogen, of which 3% was consumed. Experiments on catalytic hydrogenation at 400° C. under atmospheric pressure were also carried out using as catalysts oxides of molybdenum, aluminium, chromium, iron, etc., as well as the reduced metals. Reduced iron ore was the most resistant, and gave the best results in admixture with Cr_2O_3, the sulphur content being lowered from 10 to less than 1%. The gasoline obtained had the high sp. gr. of 0·816, being higher than that from pressure hydrogenation. G. R. N.

450. Pressure Hydrogenation of Shale Tar. I. Klyukvin, V. Efremov, and F. Meshel. *For. Petr. Techn.*, 1934, **2**, 260.—Crude shale tar (boiling range 230–340° C.) was hydrogenated in a stationary Ipatiev autoclave without agitation at 150–200 atm. and 440° C. A further increase in temperature lowered the yield of liquid products and raised the yield of gases due to cracking of both tar and products which also produced carboids and coke. An increase in reaction time increased both cracking and hydrogenation. A yield of 80–85% gasoline low in sulphur content was obtained after three recycling operations. G. R. N.

451. Hydrogenation Catalysts. E. Galle and W. Michelitsch. *Petr. Zeit.*, 20.2.35, **31** (8), 1–8.—The behaviour of molybdenum and its compounds under hydrogenation conditions is treated in detail. At atmospheric pressure and below 600° C. molybdenum forms a sulphide when treated with hydrogen sulphide, carbon bisulphide, or with mixtures of both of these. Molybdenum trioxide is converted under these conditions into a stable oxysulphide, which is finally carried over as disulphide. The use of a molybdenum on a carrier causes the end-point of the reaction to be reached more quickly. Molybdenum trisulphide is converted under hydrogenation conditions at a temperature of 450–600° C. into the disulphide.

The effect of hydrogen sulphide on molybdenum under pressure is to increase the quantity of sulphide formed compared with that obtained at atmospheric pressure. Molybdenum disulphide remains unchanged under the influence of hydrogen sulphide below 30 atm. and at a temperature of 450° C. for a period of 6 hrs.

The reaction with hydrogen is next discussed. There is no noticeable reduction of molybdenum disulphide in the presence of hydrogen at atmospheric pressure up to a temperature of 600° C., molybdenum trisulphide is reduced by hydrogen at temperatures of 450° C. and upwards to the disulphide. The oxy-sulphur compounds of molybdenum are more easily reduced by hydrogen than the pure disulphide, and when used on carrier materials they are more easily reduced than the same compounds in a pure condition.

The trisulphide is converted under the influence of hydrogen at 450° C. and under 30 atm. pressure into the disulphide.

Benzines containing sulphur convert molybdic acids when used as catalysts at atmospheric pressure into the sulphide with separation of sulphur.

Molybdenum disulphide (prepared by reduction of the trisulphide using a mixture

of 10% by volume of hydrogen sulphide and 90% of hydrogen) has a greater desulphurising influence than the disulphide obtained by reduction with pure hydrogen.

When molybdic acids are used as catalysts in hydrogenation of butyl mercaptan at an initial pressure of 50 atm., decomposition of the molybdic acid into sulphur and the disulphide takes place, an oxy-sulphur compound being formed first. High sulphur compounds are not obtained.

When molybdenum trisulphide is used as a hydrogenation catalyst for benzine containing carbon bisulphide, it is converted into the disulphide.

Pyrites and nickel sulphide showed no catalytic effect on benzines containing thiophen.

The explanation of the catalytic reaction is discussed. It could be shown that the trisulphide is converted under hydrogenation conditions into the disulphide, with simultaneous evolution of hydrogen sulphide and deposition of sulphur. The disulphide then decomposes the organic sulphur-containing compounds, the sulphur reacting to form hydrogen sulphide. If the latter gas is removed, the disulphide is decomposed superficially into molybdenum, and the hydrogenation effect ceases. By introducing hydrogen sulphide in the process the catalyst is again regenerated. This agrees with U.S.P. 1,852,988.

The disulphide which is always formed in the reaction under hydrogenation conditions liberates the sulphur from the organic compounds, which unites with hydrogen to form hydrogen sulphide. It is assumed that the molybdenum disulphide itself or the disulphide superficially present in the molybdenum converts the molecular hydrogen into atomic hydrogen.

The reaction equations are given. W. S. E. C.

452. Liquid Fuel from Ethylene. K. Smolenski and S. Kowalski. *Przem. Chem.*, 1934 (10–12), 547–551.—Polymerisation of ethylene by heating at 34–90 atm. pressure gives a liquid product equal to nearly 100% of the quantity of ethylene used. Polymerisation begins at 300–370° C., but on further heating to 400° C. quickly terminates. The quantities of the various fractions in the polymerisation product depend largely on the initial pressure of the ethylene, low pressure giving a high yield of low-boiling fractions. It is considered that the crude product obtained on polymerisation at 400° C. contains 25–30% of unsaturated hydrocarbons, the remainder being chiefly saturated. When the polymerisation is carried out at 450° C. large quantities of aromatic hydrocarbons, together with naphthenes and ethers, are produced. The pressure of Al_2O_3 as a catalyst only slightly affects the reaction. If the heating is too rapid an explosion may occur. E. F.

453. Oxidation Products of Paraffin. M. Friedwald. *Rev. Petr.*, 5.1.35 (612), 4–7.—An account (with 32 references) of investigations on the oxidation of paraffin wax by air or oxygen under various conditions of temperature and pressure with and without the aid of catalysts in order to obtain fatty acids and synthetic waxes. The work of the I.G. Farbenind. A.-G. in this field is concisely described. G. R. N.

454. Mineral Oil Sulphonic Acids. IV. S. V. Pilat and W. Szankowski. *Petr. Zeit.*, 6.3.35, **31** (10), 1–6.—Further work is described on sulphonic acids, in particular of the gamma type (cf. absts. 750 and 999 of 1934). A method is described for the separation of the sulphonic groups.

The initial material used was gamma-calcium sulphonate obtained from acid-treatment of a transformer oil. The technical product was purified and converted into the sodium salt $C_{12}H_{13}SO_2Na$. The sulphonic group was then decomposed and the ammonium salt distilled under vacuum, and then submitted to the action of hot concentrated phosphoric acid in the presence of superheated steam. A yield of 60% was obtained. Analytical data were obtained of the oil distillate and of the products of fractionation of the distillate.

The particular characteristics of this hydrocarbon group are the high values for specific refraction and a very steep temperature/viscosity curve. The ratio of C/H amounts to about 1 : 1, and this ratio still holds with increasing mol. wt., indicating that the groups appear to belong to a homologous series.

The sulphonic group combines with picric acid and other aromatic polynitro compounds, *e.g.* 2 : 7-dinitroanthraquinone or 2 : 7-dinitrophenanthrene quinone to form coloured addition compounds which can be purified by recrystallisation.

W. S. E. C.

455. Separating Mixtures of Phenols. V. I. Sabravin. *Khim. Tverdogo Topliva*, 1933, **4**, 480–491.—Phenol carbonates were obtained by the reaction of phenols with twice the theoretical amount of calcium hydroxide and passing in phosgene gas until the solution became clear. Fractional separation of the carbonates was obtained by 25% ammonium hydroxide, whereby the separation of the individual phenols depended on the ratio of the ammonium hydroxide and the time of contact.
For. Petr. Techn.

456. Absorption. A. Newton. *J.I.P.T.*, 1935, **21**, 75–88.—A paper with discussion held at the Trinidad branch on the recovery of gasoline from natural gas by the charcoal and absorption oil processes. G. R. N.

457. Refining Lubricating Oils by Solvent Extraction. J. V. Hightower. *Chem. Met. Eng.*, 1935, **42**, 82–85.—Describes the 2000 brl./day Duo-Sol plant operated by the Magnolia Petroleum Co. at Beaumont, Texas. The charge is an Oklahoma crude oil residue of 23° A.P.I. gravity and yields 1500 brl. raffinat lubs. and 500 brl. extract suitable for fuel or asphalt blending. The solvents used are propane and Selecto, consisting of 63% cresylic acid and 37% phenol. The raffinat lub. oil is clay filtered and dewaxed to give a finished lub. of V.I. 100. Oil recoveries from the process are practically 100%, and solvent losses amount to only a few tenths of a per cent. Since exact control is a feature of the process, the use of recording instruments is very extensive. Corrosion of equipment is slight, and risks of fire from the use of propane are reduced to a minimum by general use of welded joints, high factors of safety in design, etc. A simplified flow-sheet of the process is given and fully explained. G. R. N.

458. Refining Lubricating Oil by Selective Extraction. H. Burstin. *Przem. Chem.*, 1934 (10–12), 341–347.—In discussing the selective extraction of fractions obtained from Polish crude oils, it has been found that lub. oils of Pennsylvanian grade are obtainable from oils both rich and poor in paraffin and also from distillation residues. A new application for selective solvents has been found in the treatment of residues rich in paraffin, resulting in the production of a heavy lub. oil and an asphalt containing little paraffin and of good plastic qualities. Crude cresol has been found to be the best solvent. E. F.

459. Application of Physico-Chemical Principles to Liquid–Liquid Contact Equipment. Part IV. Mass Transfer to Liquids in Turbulent Flow. R. Fallah, T. G. Hunter, and A. W. Nash. *J.S.C.I.*, 1935, **54**, 49T–58T.—The problem investigated in this work was the variation of the individual liquid film extraction coefficients, with dynamic conditions giving rise to turbulent flow, of two immiscible liquids in a tower. The double liquid, wetted wall tower described earlier (*J.S.C.I.*, 1934, **53**, 369T) was used. The system examined was water–kerosine–phenol, and the paper contains useful data concerning the partition coefficient of phenol between water and kerosine at temperatures from 10° C. to 40° C. The results obtained which covered Reynolds numbers from 60 to 600 were correlated by means of the equation:

$$k_p d/D_p = 0{\cdot}94(vd\rho/\mu)^{0{\cdot}8}(\mu/D_p\rho)^{0{\cdot}44}$$

where D_p is the diffusion coefficient of phenol in kerosine, and k_p is the film extraction coefficient. This equation is compared with similar expressions which correlate gas film mass transfer coefficients and heat transfer film coefficients. W. E. J. B.

460. Transformer Oils from Russian Crudes by the Edeleanu Process. F. Frank. *Oel und Kohle*, 1935, **11**, 86–87.—In this article, Frank amplifies his reply to Calantar's paper in *Erdöl u. Teer*, 1934, **10**, 447–450 (Abstr. No. 203). He gives comparative laboratory analyses for transformer oils of American origin obtained by the Edeleanu process, and of Russian origin refined by sulphuric acid treatment, which have been used continuously in a large transformer, working under full load. He repeats his belief, that the Edeleanu process is superior as a means of removing the last traces of impurities from transformer oils. J. L. T.

461. Decolorising Earths and the French Oil Industry. R. A. Schlumberger. *Rev. Petr.*, 12.1.35 (613), 39–46.—A general article dealing with the use of decolorising earths in the refining of petroleum products by the Société de Pechelbronn, France.

The phenomenon of adsorption is lightly sketched, and the occurrence and analysis of the well-known natural earths are discussed. The activation of earths of the montmorillonite type by acids is described and the search for suitable earths of French origin is indicated. G. R. N.

462. Checking of the Deterioration Rate of Absorption Oils. W. E. Kuhn and J. F. Collins. *Nat. Petr. News*, 16.1.35, **27** (3), 21–24; 23.1.35, **27** (4), 25–28.—The authors discuss an investigation carried out to develop a series of tests which should indicate the rate of deterioration of the oils used in absorption plants. Many tests were considered, and a final choice was made of the following as tests capable of giving a maximum of information combined with ease of performance: gum content, demulsibility, specific gravity, distillation. The methods for gum content and demulsibility are special ones after Gill and Kallom, respectively. Details of these are given. Graphs and tables are presented to illustrate the fact that these tests will show the rate of deterioration of the oils with service to provide valuable data concerning plant efficiency. H. G.

463. Colour Stabilisation of Gasoline by Amines. L. V. Sorg. *Ind. Eng. Chem.*, 1935, **27**, 156.—Normal aliphatic amines up to and including the amyl amines are shown to possess colour stabilising properties, but their effectiveness is modified by the length and number of alkyl groups attached. The amyl amines are the most effective of the various amines examined, and, of these, the primary and secondary are best. Little additional improvement in colour stability is to be gained during a 1-hr. exposure in sunlight when using over 0·003% by weight of a given amine. The natural stability of the gasoline treated does not greatly affect the amount of amine necessary to secure maximum colour improvement, but the magnitude of the latter varies with it. The effect of the amyl amines is not reduced by sweetening operations. For sunlight tests, the gasoline was exposed in square quart bottles placed on an aluminium painted board, samples for colour determination being removed hourly during exposure. In order to correct for variations in the intensity of the sunlight, the uranyl–acetate–oxalic acid method was used, samples being removed hourly and titrated with standard permanganate solution. An hourly record of sunlight was thus obtained, and the decomposition of oxalic acid was plotted against colour (Say.). The test was also correlated with colour deterioration in the glass bowl of a gasoline pump, it being found that 1 hr. of sunlight is approximately equal to 8 hrs. in the pump under the same sunlight conditions. For the proper evaluation of amines it is necessary to determine the optimum concentration, variations affecting the latter, being the type and natural colour stability of the stock. To determine the amount of amine added to a given sample, the latter is shaken with a known quantity of standard acid. The excess acid being titrated with standard alkali solution, using sodium alizarin sulphonate as indicator. A blank titration indicates the presence of alkalinity for which a correction must be made. The average cost of colour stabilisation at 0·003% addition is $0·01 per barrel of 42 gallons. W. H. T.

464. Manufacture of Candles. M. Friedwald. *Rev. Petr.*, 2.2.35 (616), 147–149.—A short account of the history of candle manufacture is given and the types of wax such as paraffin, stearin, ceresin, etc., and dopes such as anilides, naphthols, etc., used in this industry are described. The treatment of the candle wick, the colouring of candles, and the making of a candle are also shortly discussed. G. R. N.

465. Hydrogenation of Phenols. B. L. Moldavskii and S. E. Livshitz. *For. Petr. Techn.*, 1934, **2**, 295.—A cresol fraction, b.-p. 210° C. (from a primary tar), was hydrogenated at various pressures using molybdenum sulphide as catalyst. The fraction boiling range 90–125° C. obtained from the final products contained 94% toluene. G. R. N.

466. Extraction of Montan Wax from Ukrainian Brown Coal. P. V. Samoilovich. *For. Petr. Techn.*, 1934, **2**, 283.—6–19% Montan wax was extracted from the above coal by a benzole–alcohol mixture followed by its separation from acids by the use of ether. Its m.-p. was 86° C., acid no. 23, saponification no. 78, and esterification no. 55. G. R. N.

467. Patents on Cracking. Brassert-Tidewater Dev. Corpn. E.P. 422,899, 14.1.35. Apparatus for coking oil in which the heat required for distillation of the charge, for fractionation of the vapours, and for fractionation of the vapours from the coking still is derived from the heavier fractions released from the tower. These fractions are heated to above the temperature at which the heated charging stock is introduced into the tower.

Gutehoffnungshütte Oberhausen A.-G. E.P. 422,971, 23.1.35. Heavy oil is preheated under pressure without distillation to a temperature below the cracking point. The preheated product is expanded and the light ends removed. The heavy ends are distilled non-destructively and the distillate cracked.

Gasoline Prods. Co. E.P. 423,292, 29.1.35. Heavy oil is preheated by direct contact with cracked vapours. Unvaporised residue and condensed vapours are cracked, the residue is removed, and the cracked vapours used for the preheating. Uncondensed vapours are fractionated, the reflux condensate is cracked in a second zone, and the products are blended with those from the first zone.

J. S. Wallis. E.P. 423,324, 30.1.35. Cracked vapours are fractionally condensed and the light condensate is treated with adsorbent. The product is blended with a heavy acid-treated distillate.

J. Y. Johnson. E.P. 423,507, 29.1.35. Heavy oil is cracked in the liquid phase (400° C. and 20 atm.) in the absence of more than 10 l. of hydrogen per kilo of liquid product leaving the reaction chamber and in the presence of a small amount of a finely-divided catalyst. The product is fractionated, the residue and catalyst are withdrawn, and the reflux condensate is re-cycled.

W. K. Holmes. U.S.P. 1,985,926, 1.1.35. Heavy oil is cracked and the cracked residue distilled at reduced pressure, the distillate being fractionated to yield a high-colour gasoline fraction. The latter is then passed to the high-pressure fractionating column attached to the cracking still, where it is reconditioned and refractionated in the presence of the initial cracked vapours.

J. C. Morrell. U.S.P. 1,986,593, 1.1.35. A mixture of coal and heavy oil is preheated and passed to a reaction zone, where vapours and residue are separated. The vapours are fractionated and the reflux condensate is blended with the coal–oil mixture. A second stream of lighter oil (gasoline) at high temperature is passed to the reaction zone into contact with the heated coal–oil mixture.

J. B. Heid. U.S.P. 1,988,842, 22.1.35. Cracked residue is distilled at reduced pressure in a coking zone. The reflux condensate from the cracking operation is re-cycled together with the primary reflux from the coking operation. The secondary reflux is cracked at high temperature and introduced into contact with the residual material in the coking zone.

G. W. Watts. U.S.P. 1,989,389, 29.1.35. A cracking apparatus with a plurality of reaction or coking chambers. Means are described for cutting-out any one chamber from the process for cleaning purposes.

L. Clark. U.S.P. 1,989,445, 29.1.35. Heavy oil is cracked by contact with hot combustion gases under pressure. W. H. T.

I.G. Farbenind. A.-G. D.R.P. 600,584, 3.12.31. Conversion of hydrocarbons in an electric arc.

S. Kulisitsch. D.R.P. 606,345, 29.11.32. A plant for the conversion of bituminous materials, in which slots are provided along the whole length of the reaction vessel through which washing gases are tangentially introduced.

Standard Oil Dev. D.R.P. 607,972, 15.2.32. Oil is cracked in the liquid phase and the products are immediately cooled and removed on reduction of pressure. L. S.

468. Patents on Hydrogenation. Technical Research Works. E.P. 422,353, 10.1.35. A method of electrolytically oxidising the surfaces of nickel or copper or their alloys. The metal is subjected to anodic oxidation in an electrolytic cell at a current density of 0·05 amp. per sq. inch of external bounding surface of the metal.

Int. Hydn. Patents Co. E.P. 422,742, 17.1.35. Separation of oil from hydrogenation residues by treatment of the latter with dilute aqueous acids at elevated temperatures whereby asphalt, solid constituents, and water are caused to separate from the oil.

Int. Hydn. Patents Co. E.P. 422,892, 21.1.35. Destructive hydrogenation of solid carbonaceous materials in which the initial materials are soaked, previous to

treatment, in a solution of catalytic or acid material in the presence of acid wetting agents (sulphonated alkylated naphthalenes).

R. T. Haslam. U.S.P. 1,988,731, 22.1.35. A portion of the oil to be hydrogenated is partly oxidised, whereby sufficient oxygen-containing compounds are produced to furnish heat upon their deoxygenation to assist in maintaining the temperature required for hydrogenation. W. H. T.

Standard I.G. D.R.P. 607,363, 2.9.31. Mo and Wo containing catalysts are recovered by roasting at temperatures at which no volatilisation of the molybdenum occurs. The molybdic acid is dissolved in acid, the tungstic acid remaining undissolved. The solution may be subjected to oxidation and then mixed with bases insufficiént for neutralisation and the molybdic acid thus precipitated.

I.G. Farbenind. A.-G. D.R.P. 607,794, 12.6.31. Coal for hydrogenation is de-ashed and mixed during hydrogenation with a coal poor in bituminous substances. Agglomeration and swelling of the coal are thus obviated.

Ges. f. Teerverwertung. D.R.P. 608,465, 20.5.28. Coal-tar pitch is desulphurized and simultaneously destructively hydrogenated in the presence of a mixture of carbides with a considerable amount of basic substances.

I.G. Farbenind. A.-G. D.R.P. 608,467, 5.4.26. A two-stage process for the hydrogenation of solid carbonaceous material. The product from the first stage is de-ashed before passing to the next stage. L. S.

469. Patents on Plant. Asiatic Petm. Co. E.P. 422,014, 3.1.35. A furnace so constructed as to burn gaseous and liquid as well as solid fuel. A burner for the gaseous or liquid fuel is situated in the upper part of the furnace and a grate for the solid fuel is fitted in the lower part.

Mather and Platt Ltd. E.P. 422,304, 9.1.35. A fire extinguisher comprising a water projector for bombarding the inflammable liquid. It comprises a scroll device with peripheral passages for giving a swirling motion to the water. A central hole is provided which diverges from the water inlet side of the scroll for the delivery of a central jet. The latter strikes the swirling jets at the throat of a converging nozzle and projects water drops at high velocity through the nozzle.

K. Sohler. E.P. 422,530, 14.1.35. Apparatus for the continuous extraction of oil from oil-containing substances. It consists of a number of extraction chambers, the first being constructed as a feed pipe for the second chamber. It is provided with perforations and is arranged in a fore-chamber, the feed pipe and adjoining extraction chamber are connected by a separate pipe.

W. G. Whitman. U.S.P. 1,986,236, 1.1.35. The corrosion of the tubes of pipe stills is minimised by the introduction of steam or water with the oil in quantities (0·05–0·4 lb. per gal.) insufficient to effect material vaporisation of the oil.

J. H. Erter. U.S.P. 1,986,254, 1.1.35. Oil is desulphurised by distillation with a catalyst, whereby the sulphur may be removed in the form of hydrogen sulphide. In order to prevent corrosion of the tower, it is covered internally with a non-metallic lining.

C. D. Gard. U.S.P. 1,988,004, 15.1.35. A distillation unit especially suitable for the conditioning of used absorption oil. It is so arranged that any section may be dismantled for inspection and cleaning. W. H. T.

I.G. Farbenind. A.-G. D.R.P. 587,776, 15.4.32. Dehydration by means of dehydrated gypsum.

M. Gensecke. D.R.P. 598,422, 12.2.31. Corrosion of condensers is obviated by degasifying the cooling medium.

Miag. D.R.P. 601,786, 27.12.32. Removal of benzine from extraction residues, using a plurality of superimposed rotating drums enclosed in a casing which serves as a receiver for the gases.

I.G. Farbenind. A.-G. D.R.P. 605,690, 3.2.33. The cooling capacities of refrigerators are determined by measurements of the circulation of the cooling medium together with the pressure difference between each side of the regulating valve.

Ges. f. Linde Eismaschinen. D.R.P. 604,773, 25.4.33. Extraction of benzene from gas mixtures by cooling and by the use of periodically renewed cold-accumulators. The material is cooled down to the dew points of the constituents to be condensed.

Eesti Patendi Aktsiaselts. D.R.P. 606,910, 22.2.29. Multi-stage distillation of bituminous substances in a tunnel-furnace using separable chambers connected with a predryer.

Metal Ges. D.R.P. 607,215, 19.8.32. Means for introducing gases into liquids by the use of a plurality of single porous plates.

W. Möhring. Austr. P. 139,857, 13.9.33. Continuous distillation to coke in a series of containers which pass at intervals through a heated furnace. On leaving the furnace, the containers are emptied of coke and recharged. L. S.

470. Patents on Crude Oil. G. Kaufman and C. E. Lauer. U.S.P. 1,986,775, 1.1.35. Crude oil containing naphthenic acids is distilled in the presence of alkali in order to obtain acid-free distillates. The residue is emulsified with water, the naphthenic acids are freed by the addition of mineral acid, and the resulting mixture of heavy oil and naphthenic acids is cracked.

C. J. Robinson. U.S.P. 1,987,870, 15.1.35. Crude oil emulsions are resolved by contact with a relatively large quantity of a coarsely powdered solid and a small amount of a finely powdered solid, both of which are insoluble and inert to the constituents of the emulsion.

M. de Groote. U.S.P. 1,988,832–5, 22.1.35. Processes for breaking petroleum emulsions, the demulsifying agents being: (1) a substituted aromatic sulphonic acid, (2) a neutral compounded sulphonating agent obtained by the reaction between chlorsulphonic acid, ethyl ether, and oleic acid, (3) a mixture of water soluble sulpho acid and a water-soluble demulsifying agent which precipitates in the presence of an alkaline earth salt, and (4) a sulpho-aliphatic ester of a fatty acid. W. H. T.

471. Patents on Gas. J. Y. Johnson. E.P. 422,272, 7.1.35. In order to prevent deposition of carbon in apparatus used for the thermal treatment of hydrocarbons, the metal is given a coating of lustrous metal (Cr, Mo, Fe, and Pb). The coating is prepared by heat-decomposition of volatile compounds of these metals (*i.e.* carbonyl compounds).

Whessoe Foundry and Eng. Co. E.P. 422,636, 16.1.35. Removal of naphthalene benzene and gum from gas by continuous spraying with a mixture of brine and a suitable naphthalene solvent such as gas oil at a low temperature. W. H. T.

F. E. Frey. U.S.P. 1,987,007, 8.1.35. A two-stage process for the production of motor spirit from such hydrocarbons as propane and butane in which pressures of 1000–5000 lb./sq. in. and temperatures in excess of 1000° F. are the conditions used in the first stage to produce olefines, while in the second stage temperature is maintained below 1000° F.

F. Winkler and P. Feiler. U.S.P. 1,987,092, 8.1.35. Contact materials used in the conversion of gaseous hydrocarbons into olefines and aromatic hydrocarbons at a temperature above 500° C. chosen from silicates, phosphates and borates of copper, manganese, lead, and chromium and applied as glazes on a refractory material such as the silicides, the carbides, or chamotte.

G. Egloff. U.S.P. 1,988,112, 15.1.35. A process for the production of unsaturated from saturated hydrocarbons by thermal treatment followed by the cooling of the products by contact with hydrocarbon liquids and/or gases and subsequent polymerisation using a suitable agent at a lower temperature than that required for the first stage. E. N. H.

Bronn. Concordia Bergbau Ges. D.R.P. 602,866, 9.8.30. Gas for engines at a pressure of 110–147 atm. is reduced before admission to the mixing chamber to a pressure of 140–280 mm. water and is preheated to 56–58° C.

Drägerwerk, H., and B. Dräger. D.R.P. 603,798, 11.7.28. Exhaust gases of I.C. engines are rendered non-toxic by filtration through cooled baffle plates followed by treatment with inorganic gels (SiO_2 or Al_2O_3), then by combustion with oxygen in the presence of contact masses (hopcalite) which act in the cold.

Oil Gas Corpn. D.R.P. 604,292, 6.12.32. Production of oil-gas in which the reaction zone is heated exteriorally so that a continuous stream of vapour from a rim of jets is introduced into a plurality of reaction zones which are fed by predetermined impact sequences of atomized oil.

Ges. f. Linde's Eismaschinen. D.R.P. 604,940, 11.7.33. Benzole is extracted from coke-oven gas by precooling the gas to near the freezing-point of the benzole, then preheating in a heat exchanger to the desired final temperature (20° C. approx.).

Bronn. Concordia Bergbau A.-G. D.R.P. 606,653, 5.4.28. Purification of coke oven gases by cooling and washing with a mixture of ammonia and acetone in the cold and under pressure.

I.G. Farbenind. A.-G. D.R.P. 606,841, 11.3.26. Conversion of methane into hydrogen by means of water vapour at elevated temperature. The catalyst used is Ni or Co mixed with compounds of difficultly reducible oxides deposited on carriers. L. S.

472. Patents on Motor Spirit. Int. Hydn. Patents Co., Ltd. E.P. 423,001, 23.1.35. Production of stable non-knocking motor fuel from unstable motor spirit of low octane number. The raw material is hydrogenated at 30–60 atm. and 450–525° C. in the presence of a catalyst. The latter contains sulphides or oxides of the metals of the fifth and/or sixth group of the periodic system alone or in admixture with sulphides or oxides of heavy metals of the first or eighth group. If desired non-reducible oxides such as zirconium, thorium, or cerium oxides may also be added.

L. J. Snyder. U.S.P. 1,985,955, 1.1.35. A process for sweetening hydrocarbon oils with sodium plumbite, in which sulphur is added in an amount just short of that necessary for the precipitation of lead sulphide. The oil is subsequently treated in order to remove the colour without further addition of sulphur.

G. Egloff. U.S.P. 1,986,190, 1.1.35. Treatment of cracked vapours with hypochlorous acid prior to and during condensation.

J. D. Seguy. U.S.P. 1,986,228, 1.1.35. Removal of hydrogen sulphide from hydrocarbon vapours by contact at 250–600° F. under pressure with an amine containing a hydroxyl group and free from carbonyl and carboxyl groups.

E. F. Engelke. U.S.P. 1,986,565, 1.1.35. Refining of pressure distillate by sweetening with an alkaline reagent followed by distillation in the presence of a sulphur-free cracked gas at a temperature at or below 400° F.

C. R. Wagner. U.S.P. 1,988,061, 15.1.35. Improvement of motor spirit by fractionation whereby pro-knock constituents—*n*-heptane, *n*-octane, *n*-nonane, etc.—are removed.

J. C. Morrell. U.S.P. 1,988,083, 15.1.35. Vapour-phase treatment with an aqueous solution of a heavy metal chloride containing sufficient hydrochloric acid to prevent hydrolysis of the chloride. The treated vapours are then fractionated in the presence of alkali.

J. C. Morrell. U.S.P. 1,988,084, 15.1.35. Vapour-phase refining of cracked gasoline by contact with an aqueous solution of a zinc salt containing an acid which prevents the hydrolysis of the salt.

G. Egloff and J. C. Morrell. U.S.P. 1,988,114, 15.1.35. Vapour-phase refining by the action of hydrochloric acid in the presence of an aqueous solution of a copper salt. W. H. T.

Benzolverband. D.R.P. 596,647, 13.11.26. Motor spirit, non-corrosive towards copper, brass, etc., is produced by an addition of tetraline twice that of the sulphur content of the fuel. L. S.

473. Patents on Lubricating Oil. J. Y. Johnson. E.P. 422,471, 7.1.35. High-quality lubricating oils are produced by removing, from cylinder oil, constituents of high mol. wt., by treatment with a liquefied gaseous hydrocarbon. A synthetic hydrocarbon material of high mol. wt. and hydrogen content is then added to the raffinate.

A. Henriksen and B. H. Lincoln. E.P. 422,956, 17.1.35. A lubricant comprising a hydrocarbon oil or grease and a small quantity of an organic compound containing a chlorinated or brominated aryl or alkyl group together with one or more other organic groups. W. H. T.

E. W. Rembert and B. Van Voorhees. U.S.P. 1,986,762, 1.1.35. Dewaxing of lubricating oils by filtration using continuous vacuum filters or discontinuous pressure filters. A filter aid is added to a chilled mixture of wax and oil, and the solvent mixture is subjected first to continuous vacuum filtration. A cold filter coke and a cold-test oil are obtained. The former is mixed with a cold solvent without further cooling and subjected to a second filtration. The cold-test oil produced is added to that from the first filtration. The process is claimed to decrease the time of filtering and give an economical wax yield.

V. C. Benjamin. U.S.P. 1,987,175, 8.1.35. An apparatus is described for the clay treatment of lubricating oils and the removal of volatile constituents. Oil is led from a supply tank by means of a conduit which is heated to a filtering element. The filtered oil is withdrawn separately while partly under vacuum to actuate oil

into and through the heated conduit and the filter. A means is provided in the heated conduit for releasing the vacuum when the temperature falls below a predetermined minimum and for re-establishing the vacuum when the temperature exceeds a predetermined maximum temperature.

M. Pier. U.S.P. 1,988,019, 15.1.35. Production of lubricating oils from coal, shale, and other solid bituminous carbonaceous materials. The material is subjected to an extraction at a temperature of 380–400° C. and under a pressure of 200 atmospheres with an oil of boiling range 300–350° C. obtained by destructive hydrogenation of coal, for a period long enough to extract the soluble constituents. The latter are subjected to the influence of hydrogen at about 400° C. and under a pressure of 200–1000 atmospheres and in the presence of a catalyst immune from poisoning by sulphur for a period long enough to cause saturation of the constituents without appreciable cracking.

E. F. Engelke. U.S.P. 1,988,648, 22.1.35. Production of lubricating oils from crude oil by treatment with 5% by wt. of 60° Be. sulphuric acid. The treated oil is removed from the acid sludge and mixed with a suitable quantity of lime to fix the oil-soluble sulphonic and naphthenic acids in the oil. The resultant oil is clay-treated, distilled and fractionated.

C. E. Swift. U.S.P. 1,988,706, 22.1.35. Dewaxing lubricating oils using propane or a mixture of hydrocarbons the major portion of which contains 3 or less carbon atoms.

U. B. Bray and C. E. Swift. U.S.P. 1,988,711, 22.1.35, and 1,988,712, 22.1.35. Treatment of asphaltic oil by dissolving in liquefied hydrocarbons, *e.g.* propane, removing the solvent from the treated oil and extracting the treated oil with sulphur dioxide to form paraffinoid and non-paraffinoid fractions.

U. B. Bray. U.S.P. 1,988,713, 22.1.35. Separation of petroleum into lubricating oil fractions by means of solvents. The asphalt is precipitated in stages using liquefied normally gaseous methane hydrocarbons of higher mol. wt. than ethane. The asphalt is separated, and the remainder of the asphalt is precipitated by adding a liquefied normally gaseous hydrocarbon of lower mol. wt.

S. A. Shaffer and E. V. Fasce. U.S.P. 1,988,753, 22.1.35. Production of dye stock to impart a green fluorescence to lubricating oils. Anthracene is added to SO_2 extract obtained by treating petroleum distillates with liquid SO_2, and the mixture is heated with aluminium chloride to 100–200° F. The aluminium chloride is separated from the reaction mixture by hydrolysis and filtration, and the filtrate is washed with water to remove the last traces of chloride, and finally submitted to vacuum distillation to obtain a lubricating oil dye stock as one of the fractions.

F. G. Baender. U.S.P. 1,988,773, 22.1.35. Recovery of used lubricating oils by first dehydrating and by heating under pressure in a closed retort to about 350° F. The retort is then opened and the steam allowed to escape gradually until the pressure in the retort is reduced to that of the atmosphere. The oil is then heated further with the retort open to about 450° F. to drive off the more volatile components of the oil. The oil is then finally deodorised and clarified by introducing into the bottom of the retort small jets of cold water to cause flashes of steam to surge through the oil.

R. E. Haylett. U.S.P. 1,988,793, 22.1.35. Solvent extraction of lubricating oils using dichloroethyl ether.

D. R. Merrill. U.S.P. 1,988,803, 22.1.35. Solvent extraction of lubricating oils using liquid SO_2 and SO_2–benzene mixtures.

H. G. Smith. U.S.P. 1,989,028, 22.1.35. Dewaxing of lubricating oils of low wax content (pour-point not $>$ 40° F.). The lubricating oil is diluted with light distillate and the resultant dewaxing stock is chilled and cold settled. The top oil from the settling stock is run off and processed to recover a finished lubricant and the wax settlings are centrifuged for the removal of wax at a lower temperature. The oil recovered from the centrifuging is either added to the top oil from the cold settling or re-cycled according to the extent of its wax content.

M. M. Moore, R. R. Thorburn, and W. B. Wilson. U.S.P. 1,989,330, 29.1.35. Clarification and decolorising of lubricating oils by heating the oil in contact with acid-treated clays at a temperature of 230° F. and under reduced pressure to prevent substantial oxidation. The oil is separated from the used decolorising agent.

E. W. Gard. U.S.P. 1,989,355, 29.1.35. Separation of resinous or wax constituents from petroleum oils. A stream of oil containing wax is passed into a mixer and chilled

with propane under pressure to separate wax. The upper layer of oil and solvent is decanted and the settling chamber, the intermediate layer of oil and solvent is continuously withdrawn and the finely-divided wax removed. W. S. E. C.

Norddeutsche Chem. Fabrik, Harburg. D.R.P. 606,346, 25.12.32. Production of bleaching earth from an iron-containing clay by decomposing it with acids and removing impurities.

M. Buchholz. D.R.P. 607,624, 9.6.33. Lubricating oils are dehydrated and rid of volatile constituents by circulation and saturation with inert gases and then subjected to a vacuum. L. S.

474. Patents on Fuel Oil. Bat. Petm. Mij. E.P. 421,928, 2.1.35. A diesel fuel oil containing small quantities of hydrocarbon peroxide (tetrahydronaphthalene). W. H. T.

475. Patents on Asphalts. G. Borotto. E.P. 422,759, 17.1.35. A floor covering comprising shredded rubber, bitumen, and rubber latex, to one or both sides of which is affixed by compression, a large mesh network of rope.

R. R. Thurston. U.S.P. 1,987,085, 8.1.35. A saturant for weather-proofing fabric, comprising a mixture of steam-reduced cracked residue with air-blown asphalt cut back with asphaltic residue.

U. B. Bray. U.S.P. 1,988,714, 22.1.35. Asphalt is precipitated from asphaltic oil by means of solvents, and the product washed free from oil with liquid hydrocarbon gases. The asphalt so produced has a softening point of 138–199° F., a penetration of 0–16, and a negligible carbene content.

U. B. Bray. U.S.P. 1,988,715, 22.1.35. Heavy oil is oxidised to produce an oxidised asphalt which is separated by solvent extraction into an oil and a bitumen. The latter is blended with oil of lower gravity–viscosity constant than that originally present.

B. G. Aldridge. U.S.P. 1,988,766, 22.1.35. An air-blowing process in which regulated quantities of a liquid heat-absorbing medium are introduced into the oil undergoing oxidation. The medium has an average boiling-point lower than the temperature of oxidation, so that the greater portion of it is vaporised in order to control the oxidation temperature.

D. R. Merrill. U.S.P. 1,989,045, 22.1.35. A solid petroleum plastic free from asphaltenes and completely soluble in naphtha and acetone, and having a lower melting-point for a given penetration than natural petroleum asphalt. The plastic bodies are found associated with the more aromatic fractions of naphthenic oil. W. H. T.

P. Lechler. D.R.P. 601,891, 17.8.31. Molten asphalt is mixed with 5% of concentrated alkaline hydroxide or carbonate solution, and emulsified by the addition of clay and water.

M. Stinnes. D.R.P. 603,762, 7.3.33. Pitch for briquetting purposes is produced by multi-stage air blowing of coal-tar oils. The pitch is removed after each stage.

E. Bergel. D.R.P. 603,801, 7.1.29. Natural asphalts rich in asphaltogene acids are added to asphalts which do not emulsify readily.

Deutsche Vialit. D.R.P. 604,328, 1.12.32. Condensation products of proteins with formaldehyde are used as emulsifying agents for stabilizing bituminous emulsions. L. S.

476. Patents on Special Products. A. Apostolou. E.P. 422,598, 15.1.35. A solid fuel, ignitible by means of a spark, consisting of a mixture of 80 parts by weight of naphthalene, naphthalene–paraffin mixture, solid cetones, or solid ether with 20 parts by weight of pyroxyle in the form of fibre or pulp.

Distillers Co. E.P. 422,635, 16.1.35. Catalytic conversion of olefines and water vapour into alcohols. The catalyst is rendered mechanically stable by the incorporation of a non-drying vegetable oil, a purified animal oil, an aliphatic alcohol, or an acid of high mol. wt. The catalyst is a phosphate containing an excess of phosphoric acid above that required to form the orthophosphate.

I.G. Farbenind. A.-G. E.P. 422,826, 18.1.35. Production of rubber-like products from olefine halides and polysulphides of the alkali or alkaline-earth metals. During the reaction, ammonia, organic bases, or their conversion products with carbon disulphide or aldehydes are added.

W. J. Tennant. E.P. 422,804, 18.1.35. Preparation of higher aliphatic alcohols

by the reaction of vegetable fats or oils with aliphatic or aliphatic–aromatic chlorine or bromine Grignard compounds. W. H. T.

I.G. (P. Baumann, R. Stadler, E. Willig). D.R.P. 606,694, 23.7.31. The gas mixture generated by electrical or thermal production of acetylene is treated with gaseous chlorine at a temperature above 80° C., but below the boiling-point of the acetylenetetrachloride. L. S.

Class 700. Utilisation.

477. Natural Gas as Fuel for Boilers. R. Orel. *Przem. Chem.*, 1934 (10–12), 510–519.—The principal component of natural gas is methane, the combustion of which is considered under the following headings: chemical and physical properties; combustion qualities; combustion diagrams; composition and quality at different temperatures and concentrations; stack losses; combustion reaction; flame formation; influence of diffusion and turbulence; conditions of air supply; heat of combustion.

The use of natural gas in a steam boiler is quoted as an example. E. F.

478. Better Cooling of Internal-combustion Engines Permits Increase in Compression Ratios. J. C. Chatfield. *Nat. Petr. News*, 30.1.35, **27** (5), 73.—Improvements in the cooling of cylinder blocks and in other elements of motor design have enabled designers to increase the average compression ratio of engines in the U.S.A. from an average, in 1933, of 5.3/1 to 6/1 in 1935. Aluminium cylinder heads have been eliminated, for the original cast iron, too, in many cases. This has been done without in any way increasing the desired anti-knock rating. H. G.

479. Fuel Consumption and Maintenance Costs of Marine Engines. L. J. Le Mesurier and H. S. Humphreys. *Engineer*, 1935, **159**, 209–210.—The items affecting a comparison of the different types of propelling machinery are given as follows: (1) Cost of machinery. (2) Bunkers. (3) Engine-room staff wages and provisions. (4) Engine-room stores, lubricating oil and water. (5) Boiler, machinery repairs, and survey.

An example is taken of vessels of 15,500 tons displacements making loaded passages of 5,000 miles, and steaming for 300 days in the year. The authors consider in detail the factors affecting the above cost items and arrive at results which are summarised below. Costs are given in pounds sterling per million ton-miles.

Type of power unit.	Machinery only, capital charges.	Bunkers.	Wages, etc.	Stores, etc.	Repairs.	Total.
Diesel machinery .	£14·10	£16·90	£5·96	£1·35	£3·03	£41·34
Turbine (oil) . .	12·90	28·4	5·70	1·06	2·92	50·98
Recip. (oil) . .	10·22	34·42	5·35	1·13	2·50	53·62
Turbine (coal) . .	13·03	25·2	8·58	1·10	3·13	51·04
Recip. (coal) . .	10·32	30·7	8·25	1·18	2·71	53·16

Fuel consumption is the most important factor affecting the relative running costs of vessels fitted with different types of machinery, the next important factor being capital cost. A comparatively small gain in fuel economy will generally prove far more important than considerable differences in relative repair costs or other factors which have been referred to. The cargo-carrying capacity may be greatly affected by the fuel consumption, depending on the trade route, bunkering conditions, and steaming radius, whilst these conditions will similarly affect the actual fuel costs. It is therefore not intended by the authors that any broad conclusions as to the most suitable type of machinery for all classes of vessels should be drawn from the analyses given. J. G. W.

480. Eben Carburation Analyser. Anon. *Aut. Eng.*, 1935, **25**, 65–67.—A description of a new instrument for automatically measuring the mixture strength from the exhaust gas of an internal-combustion engine, and an analysis of the principles of combustion on which its operation is based.

Two cells are employed, each of which forms one arm of an unbalanced Wheatstone Bridge. One cell contains a standard gas, and exhaust gas is passed through the other. The resistance of the wire through the cell varies with its temperature, which in turn is varied by the thermal conductivity of the gas surrounding it. The amount of deflection recorded on the galvanometer in the bridge circuit is a measure of the difference of composition of the gases in the two arms of the bridge, which is recorded directly as air–fuel ratio, calculated from the amount of CO_2 present in the exhaust. C. H. S.

481. Propane and Butane as Motor Fuels. W. Z. Friend and E. Q. Beckwith. *J.S.A.E.*, 1935, **36**, 36–40.—The vapour pressures of typical commercial propane and butane at 70° F. are, respectively, 124 and 30 lbs./sq. in. gauge. The fuels are handled and sold in liquid form. The main advantage of these fuels over gasoline are: first, higher compression pressures can be used so leading to increased power output; secondly, the gaseous form in which the fuels are fed to the gas–air mixer gives uniform distribution; and thirdly, decreased oil consumption and carbon formation and a consequent reduced maintenance cost. Without an increase in compression, however, no material difference in power output is generally observed, and fuel consumption in terms of B.Th.U. is about the same. These points are illustrated with data obtained from dynamometer tests of a six-cylinder valve in head engine having a 4-in. bore, 5-in. stroke, and piston displacement of 377 cu. in. Actual operating data on the road with a G.M.C.T.-60 pulling a semi-trailer and a four-wheel trailer, gross weight about 68,000 lb. are given in which propane and gasoline are compared. The authors review the economic side of the question, including potential supply of propane and butane in the U.S.A., transportation and handling costs in relation to those for gasoline, etc. It is concluded that the most logical applications are in those cases where increased power output is required, and where large quantities of the fuels can be handled at relatively few service points. General highway use appears unlikely at present prices. W. E. J. B.

482. Benzole Recovery and Production of Motor Spirit. W. Hodkinson. *Gas J.* 1935, **209**, 441–445.—Difficulties during the use of gas oil as wash oil are described, good results being obtained for three months, after which heavy sludging and formation of oil/water emulsion were experienced, resulting after six months in deposits of pitch-like material in the washer, accompanied by a fall in efficiency of the preheater. The deposit taken from the washers was dark brown, and rapidly oxidised in the air to a brittle condition. These troubles were overcome by the use of spindle oil as wash oil. Tables are given showing a comparison of the relative costs and results obtained from gas oils and spindle oils, the latter comparing favourably with the former. It is stated that partial stripping in the process of benzole washing, whilst leaving the higher boiling unsaturated gum-forming constituents in the gas, removes some form of inhibitor the lack of which is probably the cause of troubles experienced with district governors, which were found to be fouled with gum deposits. A benzole rectifying plant is briefly described, and the question of sulphur removal is discussed, including the polysulphide process of extraction of carbon disulphide. W. A. W.

483. New York State's Experience with Low Cost Bituminous Pavements. D. Noonan. *Roads & Road Constr.*, 1935, **13**, 20–23.—The construction of low cost bituminous pavements of the penetration macadam (hot and cold) retread or road mix, premix and surface treatment types is discussed and specifications for semi-solid and liquid bitumens, emulsions and materials for premixed macadam are given. A. O.

484. Utilisation of Paraffin Wax and Petroleum Ceresin. P. G. Higgs. *J.I.P.T.*, 1935, **21**, 1–24.—A paper with discussion on the modern uses of petroleum waxes with particular reference to the water-proofing of paper, polish-making, and electrical uses. G. R. N.

485. Studies in Emulsions. III. Lipin-containing Substances as Emulsifiers. R. M. Woodman. *J.S.C.I.*, 1935, **54**, 70T–72T.—Aqueous dispersions of lipins from various sources and of various ages yield dual emulsions on shaking by hand with fat solvents. Under some conditions both types of emulsions appear to be simultaneously present.

This may possibly be due to the presence, in the lipins, of opposite-type emulsifiers, which simultaneously exert their actions to some extent independently of each other.
W. E. J. B.

486. Vapour-phase Cracked Gases for Welding and Cutting. L. A. Potolovskii and P. Z. Anfinogenov. *Azerb. Neft. Khoz*, 1933, **8**, 96–102.—A welding carried out with a gas fraction containing only 50% ethylene gave satisfactory results as to the strength as well as to the metallographical structure of the seam. A further increase in ethylene content would lead to a further improvement and lower oxygen consumption. The only difficulty is the separation of gaseous olefines from cracked gases. The experiments are described and a number of photomicrographs of welded seams are presented.
For. Petr. Techn.

487. Petroleum Sulphonic Acids in the Leather Industry. D. Bazarova. *Kozhevenno-Obrivnaya Promuish. U.S.S.R.*, 1934, **13**, 121.—In the reduction of chrome tanning solution by means of glucose the latter was substituted with petroleum sulphonic acids (kontakt) the reaction proceeding as follows:

(1) $12K_2Cr_2O_7 + 11H_2SO_4 + C_{14}H_{16}SO_3 = 12Cr_2(OH)_6 + 14CO_2$.
(2) $12K_2Cr_2O_7 + 23H_2SO_4 + C_{14}H_{16}SO_3 = 12K_2SO_4 + 12Cr_2(OH)\cdot 4SO_4 + 12CO_2 + 7H_2O$.
(3) $12K_2Cr_2O_7 + 35H_2SO_4 + C_{11}H_{16}SO_3 = 12K_2SO_4 + 24Cr(OH)\cdot SO_4 + 14CO_2 + 31H_2O$.
(4) $12K_2Cr_2O_7 + 47H_2SO_4 + C_{14}H_{16}SO_3 = 12K_2SO_4 + 12Cr_2(SO_4)_3 + 14CO_2 + 55H_2O$.

Three illustrations with the application of sulphonic acids are given. It is concluded that the basicity is lowered with the increase in the amount of kontakt. Theoretically 7·3% of kontakt should be used; practically, however, an excess of the latter should be used to accelerate the reaction. It is stated that part of the carbohydrates can be replaced with petroleum hydrocarbons.
For. Petr. Techn.

488. Fat Liquoring and Impregnating Materials. I. Vaisberg and S. Gerasev. *Kozhevenno-Obrivnaya Promuish. U.S.S.R.*, 1934, **13**, 116–118.—A historical development of the gradual application of mixtures of vegetable and animal fats and petroleum products in the fat treatment of hides is given. Various proportions of cylinder oil, paraffin, petrolatum, and stripped crude oil were investigated. Best results were obtained with 70% Azneft and 30% Grozneft petrolatums, the hides being impregnated at 60° C. The effect of these ingredients on the water permeability of hides is very satisfactory, although the addition of some asphalt appears to hold the other crude oil ingredients to a higher extent. The method is used on a commercial scale.
For. Petr. Techn.

BOOK REVIEWS AND BOOKS RECEIVED.

Reviews.

HUTCHINSON'S TECHNICAL AND SCIENTIFIC ENCYCLOPÆDIA. Vol. 1. A TO DIRECTION FINDING. Edited by C. F. Tweney and I. P. Shirshov. Pp. 672. 1935. London. Hutchinson & Co. 28*s*.

In this present age of highly specialised knowledge in applied science, art, and industry, it is rapidly becoming more and more difficult for the worker in any one field of human enterprise to keep abreast of the ever-growing tide of new knowledge which irrigates and fertilises the fields of his contemporaries.

New discoveries and inventions, new applications of natural laws, revisions, reconstructions, or even rejections of older conceptions, are constantly taking place, and these changes bring with them a froth of new technical terms and novel methods of expression.

For those technologists who would swim with their heads above water in these swirling currents of applied knowledge, the subject of the present review may well serve as a plank to lean upon, or even as a raft upon which to climb in order to survey the technical landscape.

A foreword in Volume 1 refers to the Encyclopædia as "the only work of the kind to be published during the past quarter of a century." The same volume goes on to define the scope of the three volumes as traversing the whole field of Physics, Astrophysics, Horology, Electrical Communication; the whole field of Chemistry, Geology and Mineralogy; Crystal Structure and Radioactivity; the new sciences Oceanography and Geophysics. These form but a fraction of the range of subjects dealt with, and give but a poor idea of their great diversity.

It would need too much space to quote the whole range, but mention should be made of the fact that special importance is given to the applied sciences, the principal manufacturing industries, and the skilled trades, many of which have a highly specialised nomenclature and technological mode of expression.

Considering that the three volumes occupy less than one-third of a cubic foot of shelf space, the wide range of subjects premised would appear to be very difficult to cover except at the expense of easy legibility or the sacrifice of considerable descriptive detail.

Inspection of the present volume shows that this is far from being the case; the work is most emphatically a subject book, not a word book or technical dictionary. Many of the subjects are dealt with at considerable length, and adequately, even generously illustrated. Structural formulæ are used freely in the descriptions of important chemical substances, while abbreviations are employed with commendable moderation—far less, indeed, than has become customary in the abstraction of scientific articles in the technical press.

The latter tendency, while fully justified by space-saving motives, in the literature of a special branch of technology, becomes somewhat irksome to those readers who are unaccustomed to the abbreviations employed in branches of technology other than their own.

In this respect the Encyclopædia serves a useful purpose, since, in addition to the more lengthy articles, it provides concise and easily understood definitions of the special abbreviations or technical terms used in the skilled trades and manufacturing industries, as well as those of pure science.

The letter A, for instance, at the commencement of the volume is dealt with under twelve sub-headings, defining its employment in astronomy, chemistry, mathematics, electricity, telegraphy, and engineering. At the end of the volume expressions such as "D_2L" used in electrical engineering, "d" as used in chemistry and physics, "D & P" as used in commercial photography, and "D valve" in its mechanical engineering sense, are similar examples of the range covered in explaining technical abbreviations or symbols.

The work bears eloquent witness to the care and thought exercised in the allotment of space to the various subjects. In nearly every case just the right amount of useful information is given, and no more than is necessary for quick reference and rapid

comprehension. Thus the mathematician who feels a deficiency in his knowledge of plumbing can find a full description with two clear diagrams of an "Anti-vac Trap," and with equal facility can the plumber with a leaning towards higher mathematics satiate his curiosity with nearly a full-page explanation, with examples, of the Differential Calculus!

As befits its encyclopaedic form, the work is arranged alphabetically, and the sub-headings stand out boldly from the letter-press, which is itself remarkably well printed and easy to read.

It is but natural that the reviewer should succumb to the temptation to test the work in matters pertaining to Petroleum Technology, but this must be postponed until the later volumes are available, where the subject is dealt with under its designating letter. Nevertheless, some disappointment was felt that no reference could be found in Volume I to the Abel Flash-point test or apparatus, and that the word "Agitator" is only dealt with in its application to the metallurgical and paper-making industries.

Very few misprints or typographical errors could be discovered when glancing through the volume: the definition of the name "Aryl" given under the heading of Aromatic Compounds contains one misprint, where ClH_5 should be written C_6H_5.

Some criticism might be directed towards the description of the Collotype process, where it is stated that the exposed bichromated film, after treating with water, is caused to swell in the parts acted upon by light. The reviewer's impression is, that while true that the exposed portions stand up in relief, and are capable of taking ink, this effect is produced by the washing away of the still-soluble unexposed parts of the gelatine, not by the swelling of the exposed portions.

Under the heading "Colorimeter" it was surprising to find no reference to the well-known Lovibond instrument, although the Nutting appliance is adequately described, with a good diagram of the optical arrangement. Criticism on this score, however, may be not unmixed with a certain amount of professional bias, since the former instrument is closely associated with the everyday experience of Petroleum Technologists.

In conclusion, it may be stated that this Encyclopædia is a very valuable addition to technological literature, and forms a long-desired link between the many-volumed and cumbersome type of work which needs a bookcase all to itself and the scattered handbooks on specialised subjects which represent the only alternative medium for obtaining the information it provides. J. McConnell Sanders.

Strassenbau und Bitumen. Pp. viii + 287. 1935. Arbeitgemeinschaft der Bitumen-Industrie, E.V., Berlin.

A favourite form of scientific publication in Germany is composed of a series of articles on various aspects of a given topic, each contributed by a specialist, the whole being correlated by an editor or editors. The present volume is of this type, the joint editors being Drs. Heinrici and Temme. The individual essays are in all cases well and informatively written.

The opening section deals with the oldest history of the use of bitumen, and is contributed by R. J. Forbes. There is a full treatment of the well-known discoveries at Ur and Babylon, and, what is even more interesting and less well-known, the excavations at Mohenjo Daro (about 3000 B.C.), which show that the Chaldeans were not alone in their appreciation of the water-proofing and adhesive properties of bitumen.

Passing over an essay on the work of road congresses prior to the Munich Congress, in connection with which the present volume appeared, we come to a very comprehensive account of the methods of preparing bitumen, with a description of its more important properties. This is contributed by Dr. W. Becker. It is, perhaps, doubtful whether so wide a subject can usefully be treated at all in the form of an essay, especially as the volume is evidently intended for the specialist, who will require something fuller than it is possible to give in so short a space. However, the presence of the article gives the book a certain value as a text-book.

The next contribution is of outstanding importance for the theory of road construction: "The Composition of Asphalt Carpets according to the Mortar Theory," by Dr. E. Neumann and Dr. Wilhelmi. Prof. Neumann holds the view that although the usual method of specification by sieve sizes gives fairly good results in most cases,

the correct way of approaching the subject is to consider primarily the bitumen-filler mortar which constitutes, as it were, the continuous phase of the grading, and to apportion the bitumen so that the flow properties of this mortar under the range of temperature conditions to be encountered on the road will be satisfactory. He gives examples in which apparently the bitumen content when determined by the "mortar theory" gave satisfactory results under test, whereas when determined by the usual grading method, various defects appeared. These examples were taken from the experimental results with the Stuttgart model road machine. It would be interesting to follow the matter up on actual roads under traffic.

Much of the work on the properties of bitumen-filler mixtures on which the above hypothesis is based has been carried out by Dr. Gonell, who contributes the next essay: "Stone-flour as Filler in Bituminous Road Construction." This should be read in conjunction with the previous paper.

There is a very interesting section on bitumen emulsions (by Dr. Stellwaag), followed by a series of articles on progress in road construction in various important countries, each contributed by an expert. Finally, there is an appendix giving the German standard specifications for bituminous road construction.

The book is well bound and printed, and can be recommended to anyone requiring an up-to-date text-book of bitumen technology, as applied to road-making.

L. G. GABRIEL.

BITUMEN IN DER PRAXIS. Pp. 148. 1935. Allgemeiner Industrie-Verlag G.m.b.H., Berlin-Lichterfelde.

This is a collection of essays by various experts, on themes connected with the use of bitumen for technical purposes. There is no editorial link binding the separate articles together, as is the usual custom with such volumes, but the whole is easily readable, due to the restricted range of the subject-matter.

Dr. Heinrici leads off with an account of the development of the use of bitumen for road-making, and gives figures showing the progress achieved in Germany.

An interesting analysis of current German specifications for bituminous road materials is contributed by Baurat R. Westmeyer.

This is followed by a very comprehensive treatment of the various uses to which bituminous emulsions may be put, contributed by Dr. Geissler. This is particularly valuable, as it deals principally with the new methods of premix construction, and the uses of earths and other cheap aggregates, in conjunction with special emulsions, for the maintenance and construction of lesser roads, which have been developed recently in Germany, as elsewhere, and which show signs of producing a new, if restricted, field of road-making technique.

A further contribution to which special reference should be made is "The Causes of Adhesion," by Dr. Walter Riedel. This is a fundamental paper of great importance for the study of the relative wetting properties of water and bituminous binders for typical aggregates. The disintegration of road surfacings is becoming increasingly recognised as a problem involving not only traffic attrition, but also reactions and forces in play at the aggregate-binder interface. Riedel's work is a notable contribution to this difficult subject.

The other papers cannot all be mentioned in detail, but deal with the uses of bitumen in roofing, the construction of canals and water-courses, the behaviour of cut-back road carpets, and, lastly, with the desiderata in the sampling of bituminous materials.

The whole is well produced and printed, and the German for the most part presents few difficulties for anyone accustomed to reading technical documents in that language.

L. G. GABRIEL.

ANNUAL REPORTS OF THE SOCIETY OF CHEMICAL INDUSTRY ON THE PROGRESS OF APPLIED CHEMISTRY. Vol. XIX. Pp. 840. 1934. London. Society of Chemical Industry. 12*s.* 6*d.* (To members of the S.C.I., 7*s.* 6*d.*)

To review in detail a volume of this nature is manifestly impossible. The work covers in all 26 separate sections and close on 800 pages of actual reading matter. It may be said at once that the reading matter is all readable matter. Pick almost where one will there is found a critical description of the year's doings which denotes the writing of an expert. This is very pleasing, and represents a great improvement on some of the early reports which were largely as one writer himself expresess it "catalogues of patents and articles," or almost disconnected indices of papers. It is

possible in this volume, as must have been originally intended in the development of such reports, to read any one section and obtain a first-class outline of the year's progress without being lost in a mere maze of references. The Society of Chemical Industry, the Editorial Staff of the Journal, and the 35 Contributors are to be heartily congratulated on the high standard of this year's production.

The section on Mineral Oils by W. W. Goulston is particularly well done. It is significant that such an experienced technologist as Mr. Goulston should devote nearly one-sixth of his total space to a description of corrosion problems. Here indeed is one of the problems of all industry, but one, as we know, particularly evident in the petroleum world from field to refinery. The methods undertaken to counteract corrosion are legion, but chemists concerned in other directions and unacquainted with the method may find the reference to molten metal spraying of more than passing interest. The remainder of the section follows generally conventional lines. Crude Oil, Natural Gas, Refining, Cracking, and the individual products are all given their appropriate attention. The summary finishes with a sub-section on Chemical Derivatives of Petroleum. Here reference is unexpectedly omitted to an illuminating article on the subject by Ellis, which might indeed have formed the basis of this part of the report. Throughout the Mineral Oil section Mr. Goulston has done his work so commendably that it must appear a little ungracious to direct attention to the small point of his spelling of Kerosine. This spelling may be due to the editing of the Society of Chemical Industry, but, if so, the Institution of Petroleum Technologists must feel that standardization is indeed an unattainable ideal if it cannot impose its simple nomenclature within our own country.

Amongst other sections of interest and importance to Petroleum Technologists, that on chemical engineering, entitled "General, Plant, and Machinery," with its good reviews on heat transference and instruments and plant control, and the sections on "Fuel" and "Carbonization," are full and well written. Of the remainder, the references in one of the textile sections to the application of mineral oils in wool piece scouring by blending with small amounts of oil-soluble polar compounds, and similar processes complete the chief records of the use of Petroleum, with the exception of fairly generally distributed references to its growing importance as a raw material for chemical manufacture.

S. J. M. AULD.

Books Received.

API-ASME CODE FOR THE DESIGN, CONSTRUCTION, INSPECTION, AND REPAIR OF UNFIRED PRESSURE VESSELS FOR PETROLEUM LIQUIDS AND GASES. Pp. 145. 1934, Amer. Soc. Mech. Eng., New York.

In 1931, a Joint Committee was appointed by the American Petroleum Institute and the American Society of Mechanical Engineers, to prepare a code for safe practice in the design of unfired pressure vessels for petroleum liquids and gases. The present code is for vessels constructed of carbon steel, and it is anticipated that codes for other materials will later receive the attention of the Committee.

Patterson, A. M. A GERMAN–ENGLISH DICTIONARY FOR CHEMISTS. Pp. xx + 411. 2nd Edn. 1935. Chapman and Hall, London. 15*s.* net.

The first edition of this dictionary was published in 1917, and the present edition reflects the growth of the science and the appearance of new technical books. The vocabulary has grown to about 42,000 entries, and there have been numerous additions to the meanings of old words.

Spink, L. K. PRINCIPLES AND PRACTICE OF FLOW-METER ENGINEERING. Pp. 173. 2nd Edn. 1935. The Foxboro Co., Foxboro, Mass. $2.00.

The available data on the subject of liquid-flow and gas-flow measurement by means of the orifice meter have been correlated and brought together in this book.

Tookey, W. A. HEAVY-OIL ENGINE PERFORMANCES AS RECORDED ON LOG SHEETS. Pp. 26. 1934. Diesel Engine Users' Association, London. 7*s.*

A paper read before the Diesel Engine Users' Association in November 1934, the primary object of which is to correlate test-bed and industrial performances of modern high-compression airless-injection heavy-oil engines. The full report of the discussion is included.

U.S. Bureau of Mines :

THE CHEMISTRY AND REFINING OF PETROLEUM. By H. P. Rue and H. M. Smith. 16 pp. 8vo. 1934, Supt. of Documents, Washington, D.C. 5c.

A résumé of the outstanding developments in petroleum chemistry and refining in 1933.

FLUID-ENERGY RELATIONS IN PRODUCTION OF PETROLEUM AND NATURAL GAS. By R. A. Cattell and H. C. Fowler. 15 pp. 8vo. Supt. of Documents, Washington, D.C. 5c.

Some of the fundamental technical problems in oil and gas production are discussed, the nature the problems and the methods of attacking them being dealt with rather than their final solution.

R.I. 3270. SURVEY OF FUEL CONSUMPTION AT REFINERIES IN 1933. By G. R. Hopkins.

Details are given regarding the consumption of different fuels in refineries in various States. The average amount of heat required to refine a barrel of crude oil amounted to 660,000 B.Th.U., compared with 692,000 B.Th.U. in 1932 and 639,000 B.Th.U. in 1929.

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Class 100. Geographic Occurrence.

489. Trend of World Consumption of Oil and Present Statistical Position. V. R. Garfias and R. V. Whetsel. *Oil & Gas J.*, 21.2.35, **35** (40), 13.—Figures are presented showing the consumption of motor fuel (including benzole and alcohol), kerosine, gas and fuel oils, lubricants and miscellaneous products in the more important countries of the world for the years 1932, 1933, and 1934. The total world consumption and production figures for crude oil are also given.

In 1934 the total world consumption of the different products and the percentage of each product based on the total consumption in units of 1,000 brl. were: Motor fuel 574,500 (39·3% of total consumption), kerosine 117,405 (7·8%), gas and fuel oil 577,900 (39·6%), lubricants 43,845 (3·0%), misc. 146,395 (10·0%)—total 1,460,045. The total consumption of products shows a 10% increase over the figure for 1932 (1,327,807). This increase is distributed among the different products as follows: Motor fuel 6·8% increase over 1932, kerosine 14·0%, gas and fuel oil 9·2%, lubricants 13·8%, miscellaneous 14·2%.

The 1934 figures for the world production of crude oil (1,553,100,000 brl.) represent a surplus of 69,055,000 over consumption (taking into account refinery losses, crude for fuel, and consumption of by-products), making the total excess of production over consumption since 1930, 207,150,000 brl. This figure represents a reduction of stored excess products in the U.S.A. over the last five years of 136,595,000 brl., offset by an increase in the stored excess in countries outside the U.S.A. of 343,745,000 brl. It is suggested that the unstable statistical position outside the U.S.A. at the end of 1934 will probably become more acute as a result of the added Iraq production, which may jeopardise the present favourable position in the U.S.A. C. L. G.

490. Petroleum in Czecho-Slovakia. A. Červin. *Mon. Petr. Roum.*, 1935, **36**, 329–336.—The author describes fully the efforts made to discover and develop oil in Czecho-Slovakia. Oil in workable quantities is found at Gbely and Hodonin, and analyses of these oils as well as those of other smaller deposits are given. Production figures for Gbely are given for 1933 and Jan.–Aug. 1934, whilst total production of crude oil in the country for 1922–1933 is also listed. In 1933, 17,776 tonnes were produced, a slight reduction from previous years. The refining activities of various organisations are described, as well as drilling activities and the production of gas and rock asphalt. Import figures of refined and unfinished oils are given, *e.g.* 347,405 tonnes in 1933, and a full description of the customs duties in force. The article concludes with a description of the alcohol blends in use and the sale prices of the various petroleum products. 240,000 tonnes of motor spirit, containing 20% of alcohol, were consumed in 1933. A special blend containing 20% alcohol, 5–10% benzole and 70–75% motor spirit is also sold. The use of alcohol in fuel sold for power purposes is compulsory for fuels with a specific gravity less than 0·790.

W. E. J. B.

491. Petroleum and Combustible Solids in Australia. R. F. Boan. *Mon. Petr. Roum.*, 1935, **36**, 397–401.—The article opens with a discussion of the railways, mercantile marine, and aviation during 1931–1932. The number of automobiles, etc., registered up to June 30, 1932, is given. For some time past, considerable attention has been given to petroleum prospecting in the different parts of Australia. There appear to be three favourable locations for petroleum, viz. New Guinea, Kimberley in West Australia, and the Roma district in Queensland. At the latter place a natural gas, containing 10–12% condensable gases, is found; in 1931 about 5000 gal. of gasoline were produced from this source. Some authorities consider prospects here to be very good. Generally speaking, however, results to date are meagre. The imports of petroleum into Australia are given for 1933. In all about 1,319,000 tonnes were imported, including 608,643 tonnes of motor spirit, 137,437 tonnes of kerosine and white spirit, 287,258 tonnes of mazout, and 228,506 tonnes of crude. The United States furnished 35%, including almost all the lubricating oil, and the East Indies 30% of the total. The Oil Companies operating in Australia are listed, and the two big refineries near Melbourne and Sydney are described. Customs dues and taxes on petroleum products are given. Gasoline home produced from imported crude receives preferential treatment. Shale deposits are found in many parts of the country, but only those in N.S. Wales and Tasmania are of com-

mercial importance. Analyses are given of the deposits and estimated reserves. The history of the industry is outlined. Owing to extraction costs and other difficulties, the industry has collapsed, but some signs of resuscitation are evident. It is of interest to note that in 1919, more than 3 million gallons of crude oil were obtained from the shale. The remainder of the paper is devoted to the coal industry of Australia, some attention being paid to the production of benzole from the coke ovens. Since 1915, the total benzole production has been nearly 8 million gallons.

W. E. J. B.

Class 200. Geology and Origin.

492. Tatums Pool, Carter County, Oklahoma. G. Grimes. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 401–411.—The Tatums pool is an example of shore-line accumulation, and forms a link between the Carter county pools and the Arbuckle mountains. With the exception of a slightly reduced thickness of the Pennsylvanian, the section shown at the Tatums pool corresponds to the general stratigraphy in southern Oklahoma. The Tatums sand occurs in the lower part of the Grey Pennsylvanian, below the 200-ft. shale. It is found at depths of 1200–2800 ft. and has an average thickness of 125 ft. Locally it is overlain by fossiliferous limestone conglomerate, and it may discontinue as a solid sand and grade into a series of broken pay streaks. Evidence from drilling shows that the producing zone overlaps an eroded surface, and further that production from so large an area as 1650 acres is due directly to accumulation up dip against the old shore-line.

Well spacing is one well in the centre of each 10 acres. Initial closed-in pressures at the casing head are of the order of 600 pounds. The field is under proration, and the present potential is 32,000 brl. for 183 wells. Production is allowed at the rate of 23% of the potential. S. E. C.

493. Character and Possible Origin of Producing Rock in Hilbig Oilfield, Bastrop County, Texas. J. S. Smiser and D. Wintermann. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 206–220.—Production at Hilbig is from a volcanic rock lying partly within the Austin chalk, and similar in character to the producing horizon at Thrall and at Lytton Springs. Petrological examination shows this rock to be an altered basaltic tuff and lapilli tuff with inclusions of chalk and infiltrated calcareous material. It represents a submarine volcanic cone active in late Austin times, and metamorphism in the surrounding chalk is limited and local. There is no metamorphism in the overlying Taylor formation. Accumulation is influenced to some extent by the dome-like shape of the rock, but principally by the porosity, which varies with the amount of calcite incorporated. S. E. C.

494. Buckeye Field, Matagorda County, Texas. E. W. Brucks. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 378–400.—The first well was drilled on the Buckeye field in 1932, and came in as a producer at a depth of 7800–7900 ft. Since then six other wells have been drilled, of which only one has given commercial production. Production is from the upper part of the Lower Catahoula, and the thickness of the pay is not more than 50 ft. The Lower Catahoula formation is of shallow water marine origin, is very bentonic, and contains considerable amounts of volcanic ash. The sands in the producing zone are lenticular, and are not extensive. A magnetometer survey showed an uplift which confirmed surface evidence. Drilling, however, seems to point to the fact that the true uplift is smaller than that suggested by surface evidence and that it is very deep seated. S. E. C.

495. Outline of Structural Development of Trans-Pecos Texas. P. B. King. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 221–261.—The mountains of the northern part of trans-Pecos Texas are broad blocks of flat or gently tilted Palæozoic rocks resting on a pre-Cambrian basement. This northern area has been more or less stable, in contrast to the southern area. The Permian lies unconformably on the Palæozoic, and was deposited in broad basins.

In the southern area the Marathon and Solitario uplifts mark strong folds and overthrusts of late Pennsylvanian age. The sediments were deposited in the Llanoria geosyncline from the beginning of the Palæozoic; folding began in the Pennsylvanian, and finally at the end of the Pennsylvanian the folded mass was

thrust forwards. This thrust was then covered by the Permian deposits. Activity along Palæozoic structural lines had almost ceased in the early Mesozoic, and during the late Jurassic deposition was taking place in a new geosynclinal area lying west and south-west of trans-Pecos Texas. The close of the Cretaceous was marked by a period of diastrophism, which gave rise to close folds and overthrusts with broader folds in the marginal area to the east. Erosion then took place, and in early Tertiary times there was a period of volcanism, which was finally followed by a further period of movement which followed the trend of the earlier period.

Disturbances ranging in age from late Tertiary to Recent have resulted in trans-Pecos Texas being broken extensively by normal faults, the effect apparently having been the greatest in the north. There two systems may be distinguished, one trending N.–S. and the other W.N.W.–E.S.E. The Basin and Range type of feature in the north is the result of this faulting. In the south this faulting gave rise to a fault system of general N.–S. trend, and consisting of a number of parallel or en échelon fractures, the downthrow being mainly to the west. S. E. C.

496. Corpus Christi Structural Basin Postulated from Salinity Data. W. A. Price. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 317–355.—The chlorine content of waters from 1400 water wells in the Corpus Christi area, Texas, was determined and plotted in the form of isosalinity lines. The sands belong to the Beaumont and the Lissie formations (Pleistocene), and on account of the lack of data necessary for correlation purposes these sands are treated as a single water-sand.

In the East Texas basin the isosalinity lines plotted for the Woodbine sand closely parallel the structural contours plotted on top of the sand. Arguing by analogy with this case, it is suggested that the swing of the isosalinity lines in the Corpus Christi area around the head of Nueces–Corpus Christi bay indicates a structural basin. The main principle in such an argument is that surface waters flow down dip through all sands at an approximately uniform rate from all points along the outcrop and mix with indigenous brines. All available evidence is collected and examined, and alternative hypotheses are considered. The final conclusion, however, is that the hypothesis outlined above is the most probable, and what is known of general structural conditions in the region of the Texas bays would seem to support the contention that a structural basin exists in the Corpus Christi area. S. E. C.

497. Upper Permian Formation of Delaware Basin of Texas and New Mexico. W. B. Lang. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 262–270.—The Delaware basin had its maximum development during the upper Permian, and shows the greatest thickness of upper Permian deposits known in the south-west. The Means well in central E. Loving county provides the type section, although it must be realised that representative outcrops are not found on account of alteration due to weathering or of lateral change.

Beneath the Trias red beds are 350 ft. of sandy red beds with thin selenite veins which form the Pierce Canyon formation (Permian). The Pierce Canyon rests unconformably on the Rustler formation, the top of which is marked by a 30-ft. massive anhydrite bed. This in turn rests, also unconformably, on the salt series, which can be divided into an upper and a lower division. The upper division is here called the "Salado halite," and is composed mainly of rocksalt with massive anhydrite beds, red beds, shaly sands, and polyhalite. Potash salts are mined in the upper part, and the total thickness is of the order of 1450 ft. The lower division, the Castile anhydrite, has a thickness of 2600 ft., and rests unconformably on the Delaware Mountain formation. It is composed of massive beds of grey anhydrite, white rocksalt, dolomitic and crystalline limestones, and sandstones. S. E. C.

498. Marine Oil Shale, Source of Oil in Playa del Rey Field, California. H. W. Hoots, A. L. Blount, and P. H. Jones. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 172–205.—The formations represented in the Playa del Rey field are Pleistocene, the Pico and the Repetto groups of the Pliocene, the Lower Modelo of the Upper Miocene, and the Franciscan schists (Jurassic?). The structure is that of a broad, gently flexed fold broken locally by faults, and probably terminating in the N.W. against the E.–W. zone of faulting bordering the southern edge of the Santa Monica mountains. There are two main oil zones, one in the Repetto group and one in the base of the Modelo directly above the Franciscan schist. The Pliocene deposits do not appear to be likely source rocks and, although a thick series of impervious rocks occurs between

the Lower Modelo shales and the Upper horizon, upward migration might have been facilitated by faults and, in fact, free oil has been found to be associated with the faults. Considerable space is devoted to a discussion of the organic content of the Modelo shales. The Modelo at Playa del Rey is divided into three sections. The lowest is a basal conglomerate, and forms the lower producing horizon. It was deposited on the eroded surface of the Franciscan schist, and varies in texture from fine up to very coarse with boulders. The middle section is a nodular oil shale, 100–150 ft. thick, and the upper section consists of siliceous shales and siltstones with interbedded thin sandstones. The lower 100 ft. of the upper section and the whole of the middle section have a considerable organic content. It is of interest that these shales and the oil both have an unusually high sulphur content, and furthermore the distribution of the shales and the oil is similar. The shales also contain a considerable content of free oil, the properties of which suggest that it is the residuum after migration of the lighter fractions of the original oil. The conclusion is therefore that the Modelo oil shales are the source rock at Playa del Rey, and migration took place from them into both the lower and the upper horizons. S. E. C.

499. Athabaska Oil Sands: Apparent Example of Local Origin of Oil. M. W. Ball. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 153–171.—The Athabaska oil sands occur in the Lower Cretaceous McMurray formation in N. Alberta, and rest unconformably on the peneplained surface of compact Devonian limestones. The oil sands are exposed in the banks of the Athabaska river and its tributaries, which have cut deeply into the Cretaceous. The oil is very heavy with an asphaltic base and high sulphur content, and is characterised by the fact that it begins to crack at temperatures considerably below normal cracking temperatures. It is suggested on this account that the oil has not been subjected to heat or pressure due to folding, and is therefore not a residual oil. The sands are of deltaic origin and, whilst extending over large areas, thin out rapidly at least to the south and south-west. An interesting point is that the oil is the sole cementing medium in the more massive sections, and that a thin film of water seems to surround each sand grain beneath the oil. When considering the origin of the oil, many difficulties arise. Release from some closed reservoir and deposition contemporaneous with that of the sand appears to be ruled out by the fact that the oil does not seem to be oxidised. Lateral migration over long distances along the unconformity does not seem feasible on account of its being too flat, whilst the suggestion that oil originated in the Great Plains geosyncline and migrated through a continuous sheet of sand to the Athabaska outcrop appears to be negatived by later evidence that no persistent sandstone exists. It is therefore considered that the oil was either formed in the sands themselves or in the overlying shales. S. E. C.

500. Experiments on Soft-rock Deformation. R. E. Rettger. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 271–292.—A number of experiments were carried out in large glass tanks to study the deformation of soft sediments produced by slump, differential movement, and differential loading. Fine-grained sands and clays were used. From the results obtained criteria are suggested by which soft-rock deformation may be distinguished from hard-rock deformation. It is shown that clays and sands deformed while wet never show clean breaks; there is always some irregularity and drag. Cavities are not produced and, although in some cases irregularities develop which have the appearance of fault plane filling by cementing material, it is possible to connect these irregularities with the surrounding material. Another characteristic is the non-uniformity of the positions of the faults and the movements along them. S. E. C.

501. Relation of Geophysics to Salt Dome Structures. J. B. Eby and R. P. Clark. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 356–377.—Eighteen geophysical maps illustrating nine structures on the Texas and Louisiana Gulf Coast are given. Short notes on each structure are appended. The maps are given with the object of providing type pictures of the effect of various structures.

The Fannet dome illustrates a shallow structure giving a gravity maximum, whilst Moss Bluff is a shallow dome giving a combination of gravity maximum and minimum. Sugurland is a medium depth dome with a gravity minimum. Six deep-seated structures are given, these being characterised by gravity minima.

Gravity, seismic, and magnetic effects are shown. S. E. C.

502. Electrical Surveying in U.R.S.S. C. and M. Schlumberger and P. Charrin. *Rev. Pétr.*, 1935, 77–83, 110–116.—In the Baku, Grozni, and Maikop regions the presence of thick argillaceous horizons, which are good electrical conductors, makes electrical surveying practicable. Some results obtained both by electrical prospecting and electrical coring previous to 1934 are discussed. To illustrate the work done by electrical prospecting the more important results obtained in the Grozni, Baku, and Emba districts are given. The discussion on electrical coring is limited to the Baku area, since it has reached its greatest development there, and has almost supplanted mechanical methods of coring. In each field a characteristic resistivity profile is established, and this is used as a basis of comparison for the profiles obtained from other wells. Measurements made at Kala are discussed in some detail. Kirmakou and Lok-Batan are also mentioned, the latter being of interest since prospecting and exploitation work has been carried out solely by electrical methods. S. E. C.

Class 300. Development and Production.

503. Termites. A Menace to Company-owned Properties, but Controllable. R. W. Parker. *Petr. Eng.*, March 1935, **6** (6), 39.—A description is given of the habits of termites and of the destruction which they cause to wooden structures, and recommendations are given for the control of these pests.

It is estimated that termites cause destruction of wooden structures in the U.S.A. costing $40,000,000 p.a.

Control can be effected by either (*a*) changing the construction of derricks, structures, etc., and by using concrete and other shields over foundation walls, or by (*b*) chemical means. (*a*) is the more expensive, but an investment of 2% on the cost of a building will render it termite-proof. (*b*) The habits of termites render the normal means of insect control unpractical. The recommended treatment of infested structures consists of first removing all loose wood from underneath and making openings in the foundation wall. Spraying is then effected with an insecticide which is both toxic and penetrating, water base sprays being more toxic and less penetrating, and petroleum base sprays the reverse. A recommended spray consists of: 50 parts mineral spirits or crude oil, 40 parts crude carbolic acid (33%), 10 parts *para*-dichlorobenzene. If flowers or shrubbery are near the building, the following is used: 50 parts crude oil, 25 parts crude carbolic acid (33%), 20 parts pine tar oil, 5 parts *para*-dichlorobenzene. The U.S. Bureau of Entomology recommends a 10% aqueous solution of sodium arsenite. Other compounds which have been tried out are: *ortho*-dichlorobenzene, CS_2, CCl_4 and benzole. Infested cracks in masonry are treated with hot creosote or by blowing poisonous dusts down them and sealing with hot asphalt.

New buildings should be treated with copper sulphate, zinc chloride or borax solutions, but permanency cannot be guaranteed, 5 years being the usual guaranteed limit. C. L. G.

504. Rig Lighting. J. C. Albright. *Petr. World* (LA), 1935, **32** (2), 35.—The systems of drilling rig lighting used in California to-day not only make it possible for wells to be completed in less elapsed time, but have also been instrumental in preventing many disastrous fires which could have occurred from gas being ignited by open flames and poor wiring. One company uses 6550 watts per rig in illumination while drilling. In this instance four 500-watt lamps are used as floor lights and the derrick string contains six 200-watt lamps. The floor lamps are equipped with frosted bowls and a 500-watt floodlight is placed up in the rig. Two 150-watt lamps are used on the crown and three 150-watt lamps are placed in the engine-house. The mud pumps are illuminated with two 220-watt lamps with an additional 200-watt lamp placed outside. Lamps are also placed over the ditch, in the cellar, over the walk in the dog-house and one over the dog-house steps.

Another major company uses only 3100 watts at drilling wells, and maintains that the total wattage does not matter so much as do the location and arrangement of the individual or group of lamps. Vapour-proof or explosion-proof switches are installed in all instances, together with standard galvanised conduit where atmospheric conditions are not severe. When locations are made near the surf and at off-shore locations, corrosion-resisting material is used. W. W.

505. Developments in Gas Engine Design. A. K. Hegeman. *Petr. World* (LA), 1935, 32 (2), 53.—Considerable research and design work has been done by manufacturers of oilfield internal-combustion engines during the recent lull in business, with the object of improving their equipment in anticipation of a revival in demand. Most of the effort expended has been directed towards obtaining more horsepower per pound of metal: (1) By development of lighter, higher-speed designs; (2) by increase in piston speed of present designs; (3) by attainment of increased thermal and mechanical efficiency through improvement of existing designs.

Improved features in several types of engines are commented upon, and in dealing with the larger types with stroke ranging from 8 to 12 in., speeds from 450 to 800 r.p.m. and outputs of 30–300 h.p., the Author advises that operators should compare the units offered, not so strongly upon catalogue ratings, but upon a common b.m.e.p. and piston-speed basis. Some manufacturers rate their engines rather closely to the power developed on test; others, more conservative, rate them according to the load which they can be expected to carry continuously without undue difficulties. B.m.e.p. ratings of between 65 and 70 lb./sq. in. may be considered reasonable for engines of this type. W. W.

506. Some Experiences in the Use of Drilling-Fluids, Yenangyaung, Upper Burma. A. W. G. Bleeck. *Trans. Min. Geol. Inst. (India)*, 1934, Part 3, 187–218.—Experience, corroborated by laboratory work, has shown that trouble caused by heaving and caving can in most cases be entirely, and in other cases partly, overcome by using a drilling-mud from which there settles out a minimum of free water, since it is the water which causes the shales to disintegrate and flow. In addition to using mud having this characteristic, every precaution must be taken to prevent water from entering the hole from the formation and contaminating the drilling-fluid. To achieve this purpose the drilling-fluid must (i) be sufficiently heavy to over-balance the pressure of the formation water, or (ii) be loaded with barytes, iron oxide, etc., and/or (iii) an artificial back-pressure must be applied to the column of drilling-fluid by means of special drilling equipment.

In this paper, the Author records his observations made on a well, fitted with back-pressure equipment for the purpose of deepening with the use of loaded mud, near the southern extremity of the Yenangyaung field in Burma. The well had been producing oil from 4100 ft. for two years, 11¾-in. casing having been cemented at 3670 ft., the objective being an oil series lying between 5100 and 5400 ft. The bottom-hole water and gas pressure of a neighbouring well drilled to 4850 ft. was calculated to be 3800 lb./sq. in.

Clay giving a drilling-fluid weight of 68½–69 lb./cu. ft., which settled out less than 1% by volume of water in 24 hrs., was used successfully in drilling the hole from 4100 to 4782 ft. In order to keep the drilling-fluid in the best possible condition and as free as possible from drill-cuttings and sand, the entire circulation was renewed for every 100 ft. of drilling. Actually this proved unnecessary as the same fluid would, no doubt, have served in making three times the amount of hole. The question of reconditioning used mud by screening, etc., was carefully considered, but was found to be much more expensive than using new mud even as frequently as stated above. The drilling-fluid log and core log are given in the appendices of the paper.

After landing 8¼-in. casing at 4771 ft., mud loaded with barytes (ground to pass a 200-mesh screen) to give a weight of 108 lb./cu. ft. was used. The loaded circulation was carried without renewal or replacement from 4771 to 5060 ft. The viscosity of this fluid was very high to start with, and initial pump pressures were 950 to 1000 lb./sq. in. A gas-sand started dehydrating the mud at 4850 ft., causing the pump pressure to rise to 1650 lb./sq. in. Viscosity of the mud was reduced by adding water, sodium tannate and sodium silicate.

On the well under discussion high-pressure water-issues were not found, and back-pressure exerted by means of pumps, stuffing box and beans, though ready to be used, was never required. The snubbing arrangement, with which the well was equipped, never had to be operated. The Author considers that the use of good mud-fluid prevented all trouble, especially if it is correct to assume that alleged high-pressure water is often explainable by "flowing shales." Such flow, once started in consequence of the use of poor-quality drilling-fluid, gains volume and creates a pressure which it may become quite impossible to control. The same

conditions would arise if a water issue were allowed to over-balance, to any appreciable degree, the pressure exerted by the drilling-fluid column. W. W.

507. Control of Colloidal Properties are Vital in Mud Conditioning. W. A. Sawdon. *Petr. Eng.*, February 1935, **6** (5), 50.—The advent of the very deep wells has undoubtedly accelerated the development of drilling technique, and mud control is an important factor of the technique.

The functions of a good drilling-fluid are, in general: (*a*) to remove cuttings from the well, (*b*) to lubricate the walls of the hole, drill pipe and mud pump, (*c*) to provide a means of holding solids in suspension whilst circulation is stopped, (*d*) to seal formations, (*e*) to prevent caving, and (*f*) to provide a head that will exert pressure on the formation. Functions (*a*), (*b*) and (*c*) are all dependent on the colloidal properties of the fluid. The fluid head is obtained by weight.

Under ordinary conditions there will be a sufficient percentage of colloidal material to give consistently good results, but some wells need a fluid of varying colloidal properties as they progress. Mud conditioning in these circumstances is an essential factor in the success or failure of the operation.

Colloidal properties and conditioning of the drilling-fluid are explained and graphs are included to assist the explanations. L. V. W. C.

508. Central Mud Reconditioning Plant is Reclaiming Weight Material and Aiding Mud Control. W. A. Sawdon. *Oil Weekly*, 11.3.35, **76** (13), 28.—Mud conditioning and the use of admixtures are being given considerable attention to meet subsurface contingencies as they occur. Certain conditions may arise which greatly deteriorate the mud, and may necessitate the dumping of large quantities of drilling-fluid containing admixtures of value. These materials can often be recovered by the aid of central mud reconditioning plants.

The General Petroleum Corporation has built such a plant in the Ventura Avenue Field, and the results obtained have demonstrated both its efficiency and economy.

In this plant the mud first passes through a vibrating screen with 60-mesh screen, water being added to assist the washing out of the sand. At present about 1% of sand is left in the mud after it has passed through the screen.

From the screen the mud passes to a centrifugal separator. The heavy material is thrown outwards to the periphery, and the heavy portion of the fluid passes out through horizontal nozzles into an outer chamber. This heavy portion is weighed continuously, and circulated until a predetermined weight is obtained. The heavy fluid is then diverted to a storage tank.

The heavy portion taken off by the separator consists almost entirely of weight material and water, and is practically devoid of colloids. Colloidal material is, therefore, added before settling can take place in the tank. L. V. W. C.

509. Viscometric Measurements on Clay Suspensions. G. D. Hobson. *J.I.P.T.*, 1935, **21**, 204–220.—An account of previous work on this subject, together with the results of the Author's experiments on Stockolite and Aquagel suspensions.

G. R. N.

510. Back-Side Crank Pumping. W. C. Lane. *Oil Weekly*, 4.3.35, **76** (12), 31.—A number of sections of the Mid-Continent area have made use of back-side crank pumping during the last two or three years. This method is an arrangement for operating one or more wells from a back crank on an ordinary standard rig or from one of the different types of geared, V belt or chain-driven pumping units now available.

This method is especially adaptable to fields where there is an uncertainty as to the future needs of the wells.

Actually the system is simply a method of operating a rig designed for pumping one well as an abbreviated central power, the capacity of the jack being limited to about the same amount as normally.

A few simple principles must be observed in locating the front and rear cranks with respect to one another, and these are explained in the article.

L. V. W. C.

511. Study of Oilfield Water Analysis. Part V. Estimation of Potassium. W. R. Wiggins and C. E. Wood. *J.I.P.T.*, 1935, **21**, 200–203.—An account of a rapid

colorimetric and two volumetric methods for the estimation of potassium using sodium-6-chloro-5-nitrotoluene-3-sulphonate as the precipitating reagent.

G. R. N.

512. Efficient Production Obtained in West Texas by Tubing Practices. B. Mills. *Oil Weekly*, 4.3.35, **76** (12), 25.—Operators in the West Texas fields have resorted to the use of tubing to keep the weaker wells flowing, to reduce gas–oil ratios, and to obtain a more efficient production from wells capable of producing little more than their allowances.

A large number of experiments have been carried out using various sizes of tapered and straight strings, and results in a number of the low-pressure flowing wells indicate the advantages of tubing strings with small displacements over the larger straight strings.

Special tubing strings have been installed in many cases, and the gas–oil ratios in these revived wells have been no higher than they were while these wells were on the pump.

One Company has developed a double tubing string. A string of 2-in. tubing is run and equipped on the bottom with a special connection and seat. A 1-in. or ¼-in. string is then run and set in the seat at the bottom of the 2-in. string. This second string reaches about 500 ft. up the large string, and serves to convert the straight string to a tapered string.

Special packers are being run in some fields, with marked success, and running tubing under pressure is quite common practice in a number of fields.

L. V. W. C.

513. Proper Back-Pressure at Well will Keep Aerated Gas Usable. C. E. Morris. *Oil Weekly*, 4.3.35, **76** (12), 19.—Considerable attention is being directed to the use of compressed air on the " five spot " method due to a successful experiment in keeping the air–gas mixture up to a combustible fuel for gas engines.

An engine is much more sensitive in its operation on badly aerated gas, and will quickly cease to work when the gas is not exploding at each compression of the engine. The supply of gas to the main must be regulated at the well, and aerated gas requires more careful regulation than does gas without air mixture. Several ways exist for regulating the supply of gas, but a more conservative method of holding the gas line pressure down is to control the high volume wells at the casing heads by back-pressure. This conserves the gas and has a tendency to increase its fuel value.

An example is given to illustrate the use of back-pressure as a means of increasing the value of aerated gas.

L. V. W. C.

514. Data on Water Drive in East Texas Show Proper Method of Producing. T. V. Moore, *Oil & Gas J.*, 14.3.35, **33** (43), 11.—A wealth of data from the East Texas field have been accumulated on the properties of the oil and gas produced, the nature of the reservoir, the sources of the energy by which the oil is produced and the behaviour of the field under varying rates of withdrawal.

From these data it has been shown that the average reservoir pressure, which was originally 1625 lb./sq. in., has never fallen below 1220 lb./sq. in. The productivity of the wells has thus been maintained and the flowing life prolonged notwithstanding the fact that 644,000,000 brl. of oil were produced prior to January 1st. In addition, it has been shown that the rate of production affects the rate of decline in pressure and the pressure within the field is highest along the western boundary and lowest along the eastern boundary. The pressure distribution is not appreciably affected by heavy withdrawals from small areas.

These facts alone suggest that the field is under water drive, and the data from the field verify this conclusion.

Important conclusions can be reached from these data. The fact that the reservoir pressure has been maintained means that the space originally occupied by the oil that was produced has now become filled with some other substance, and since the pressure has always been maintained in all parts of the field at a higher value than the saturation pressure, free gas could not have been the substance replacing the oil. Finally the maintenance of pressure can only be explained by water intrusion or a decrease in the porosity of the reservoir rock.

The theory of water drive being the only tenable explanation of the behaviour of

this field, the proper method of producing this field is by forcing the water to furnish all the energy necessary for oil production, whilst all the gas is kept in solution in the oil. The rate of removal of the oil must be such that the water continues its complete replacement of the oil in the pore spaces in the sand and the pressure is maintained above 730 lb./sq. in. L. V. W. C.

515. Patents on Drilling Apparatus. R. C. Baker and C. E. Burt. U.S.P. 1,992,933, 5.3.35. Cement retainer.

J. J. Santiago. U.S.P. 1,993,182, 5.3.35. Hydraulic expansive under-reamer.

J. H. Bettis. U.S.P. 1,993,258, 5.3.35. Paraffin scraper for plunger lift devices.

L. Evans. U.S.P. 1,993,266, 5.3.35. Plunger lift device.

H. W. Fletcher. U.S.P. 1,993,269, 5.3.35. Pipe joint and method of construction.

F. L. Scott. U.S.P. 1,993,286, 5.3.35. Drill cutter.

H. B. Woods. U.S.P. 1,993,292, 5.3.35. Flow regulator for plunger lift pumps.

C. J. G. Aarts and J. A. A. Mekel. U.S.P. 1,993,641, 5.3.35. Method of making vertical boreholes wherein the formation is made molten by passing an electric current.

C. J. G. Aarts and J. A. A. Mekel. U.S.P. 1,993,642, 5.3.35. Apparatus for making boreholes by the electrical method.

E. E. Greve. U.S.P. 1,993,739. 12.3.35. Casing elevators.

I. C. Harris. U.S.P. 1,993,740, 12.3.35. Weight indicating rotary swivel.

L. Dillon and R. W. Phelps. U.S.P. 1,993,877, 12.3.35. Casing meter.

J. A. Hardcastle. U.S.P. 1,994,072, 12.3.35. Cementing plug.

E. W. Pittman. U.S.P. 1,994,110, 12.3.35. Oil and gas separator.

W. E. Harrington. U.S.P. 1,994,344, 12.3.35. Well screen. L. V. W. C.

Class 400. Transportation, Storage and Distribution.

516. Celluloid Used to Combat Corrosion and Stress. L. E. Bredburg. *Oil & Gas J.*, 14.3.35, **33** (43), 13.—Experiments are being carried out in Texas to test the efficiency of celluloid as a covering to protect pipe-lines from corrosion and soil stress.

The celluloid shield is known as "celluloid nitrate plastic," and is received by the experimenters in layers ten one-thousandths of an inch thick. It is inflammable, flashing at 525° F., but with reasonable care no danger from fire need be anticipated. The material has a tensile strength of 8000 lb./sq. in. It is brittle at — 20° F. and softens at 220° F. with rapid decomposition at 325° F. It will expand 5% by volume on softening and shrink 12% by volume when hardening.

It may be applied with an air-spray pump in liquid form, but the better method is to apply the sheets by hand, using a special cement to seal tightly the edges of the wrapped celluloid. L. V. W. C.

517. Nomographic Charts for Determining the Fluid Friction in Pipe-Lines. H. V. Beck. *Oil Weekly*, 4.3.35, **76** (12), 33.—This article describes nomographic charts for the determination of the frictional resistance to a fluid flowing in a pipe-line. L. V. W. C.

518. Volume Correction Chart. M. G. Van Voorhis. *Nat. Petr. News*, 20.2.35, **27** (8), 34.—A description is given of a chart from which the volume of a gasoline observed at a temperature t may be converted to volume at 60° F. due regard being taken of gravity. The chart is reproduced in the article, and is available through the publishers. H. G.

519. Corrosion of Motor Fuel Containers. P. H. Grempe. *Oel u. Kohle*, 1935, **11**, 118–119.—Corrosion of brass, iron, and lead-lined iron tanks has been observed when the fuel contains sulphur compounds or is blended with alcohol. A sludge taken from a lead-lined iron tank consisted of 42% mineral matter containing 68·6% lead oxide and 19·9% iron oxide. A green deposit from a brass tank consisted of 22·8% mineral matter containing 23% copper, 32% zinc, and 16% lead. The green colour is due to organic copper salts. Pure benzine or benzoles do not attack brass, whilst tinned containers are not affected by fuels which attack copper and lead. The corrosive action of alcohol is attributed to the presence of aldehydes and organic acids, and that of benzine and benzole to corrosive sulphur. Water accelerates corrosion. If an alcohol fuel is used after benzole or benzine, the greater solvent action of the former

may partly dissolve deposits left on the walls of the container by the benzine. The residual insoluble material may collect in powder form on the gauze and restrict flow. It is concluded that lead-lined and galvanised containers should be avoided, but tinning is satisfactory. C. C.

Class 500. Properties and their Determination.

520. Application of Physical Constants to the Analysis of Motor-fuels. M. Marder and Collaborators. *Oel u. Kohle*, 1935, **11**, 182, 222.—Comparison with existing methods has shown that certain physical constants can be of value in determining the composition of light fuels.

Exploratory work was carried out on known mixtures of pure unsaturated and aromatic hydrocarbons with aromatic-free benzine, the density (d_{20}) and refractive index at 20° C. being measured before and after treatment with (*a*) sulphuric acid, (*b*) mercuric acetate or mixtures of (*a*) and (*b*). The conclusions were then checked on actual benzine fractions.

The *aromatic content* given by density measurements was as accurate as that derived from volume changes; refractive index or specific refractivity (R_s), being little changed by removal of aromatics, were unsuitable for estimating the latter. Before treatment with sulphuric acid, unsaturateds should be removed by some pretreatment (*e.g.* by mercuric acetate) to ensure accuracy.

If it can be assumed that the naphthenes belong only to the *cyclo*hexane group, d_{20} and R_s can give approximate *naphthene and paraffin* contents.

By combining two physical constants, as, for example, in R_s or the parachor (derived from surface tension and d_{20}), valuable information may be obtained. The parachors of a fuel, before and after removal of a given hydrocarbon group, enable the parachor of that group to be calculated and certain conclusions to be reached as to structure. By this method indications may be obtained as to the average number of double bonds in unsaturateds, the degree of hydrogenation of aromatics, the average number of side-chains in paraffins, and the number of C atoms in naphthene ring compounds.

The R_s may be applied to the determination of saturated hydrocarbons, only the R_s and the boiling range of the aromatic-free fuel being necessary for the evaluation of naphthenes and paraffins; the results so obtained are stated to be more accurate than those from aniline point measurements. P. G. H.

521. Absorption Spectra of Mineral Oils. E. Vellinger and A. Klinkenberg. *Ann. des Comb. Liq.*, 1935, **10**, 79–93.—This article is a report on the continuation of the Authors' researches into the subject of absorption spectra of mineral oils. In this series of experiments ultra-violet light is employed in a spectrometer using "Zeland" quartz. Four types of oils of varying degrees of refining are investigated, and curves obtained by plotting the log of the absorption coefficient against the wave-length of the light in Angstrom units. The curves are irregular in character, whilst the absorption coefficient is found to decrease with increasing extent of refining. From the results obtained with simple hydrocarbons it is calculated that benzenoid and condensed nuclei are present in fairly considerable proportions in the lubricating oil fractions from petroleum. It is concluded that moderate ageing of mineral oils at 110° C. in the presence of copper does not produce any characteristic modifications of the absorption spectra. However, the resulting curve is smoother than for the fresh oil, whilst the products of considerable ageing (sludge) give a curve which is practically linear over the whole range of wave-lengths considered, and is similar to the curve obtained with bitumen. J. L. T.

522. Laboratory Evaluation of Oil Stocks. W. L. Nelson. *Refiner*, 1935, **14**, 67–72.—The several methods of laboratory distillation discussed in Part 1 should be supplemented by an analysis of the results by means of curves. Two types of these are useful, the one, the differential or mid-per cent. curve, so named because the property of each of the fractions is plotted at the mid-per cent. point of the fraction, may be applied to gravity, viscosity, and vapour-temperature. The second type, viz. integral average or yield curves, differ from the preceding because they show the average property of a range of material rather than the property of a narrow fraction. Two kinds are common: one showing the yield of bottoms or residue product, and the other the property of the total distillate cut to a given percentage.

Examples of yield curves are the flash, viscosity, gravity, penetration, flash-point, octane, and end-point yield curves, and are usually obtained by blending fractions together to produce the several bottoms products. Typical evaluation analyses are discussed in the light of the above. B. C. A.

523. Cold Test for Fuels. B. H. Moerbeek and A. C. van Beest. *J.I.P.T.*, 1935, **21**, 155–168.—A lecture with discussion on the objections to present methods of pour-point determination, together with an account of the Authors' method designed to give better correlation with the behaviour of fuels in practice. G. R. N.

524. Dependence of Methane–Oxygen Low-Pressure Explosion Limit on Nature of Reaction Vessel Surface. H. H. Storch. *J.A.C.S.*, 1935, **57**, 685–686.—The Author presents data re the lower explosion limit of methane–oxygen mixtures in a quartz vessel in the temperature range 602–642° C. Treatment of the surface of the vessel with aqueous hydrofluoric acid reduced the induction period of the reaction to about 3 minutes, but the time of contact of the acid treatment affected the lower explosion limit enormously. The age of the treated surface also affected the results. Other surface treatments were tried, *e.g.* a silver mirror was deposited on the reaction vessel wall. However, in the temperature range investigated, no explosions were found with mixtures having an O_2/CH_4 ratio appreciably less than 2·0. The Author concludes that it is necessary to discover a surface which is accurately reproducible and which does not age rapidly. W. E. J. B.

525. Simplified Method for the Carbon Content of Organic Compounds. C. B. Pollard and W. I. Forsee. *Nat. Petr. News*, 20.2.35, **27** (8), 36; *Ind. Eng. Chem. Anal. Ed.*, **7**, 77 (1935), **6**, 277 (1934).—The method is a modification of the wet oxidation method after Adams. A Kjeldahl flask has a dropping funnel welded into its side and its neck filled with glass wool to trap acid vapours. Oxidation is by means of sulphuric acid and chromic acid admitted through the dropping funnel. CO_2-free air is aspirated through the apparatus and CO_2 is estimated by absorption. H. G.

526. Isomeric Thiophthens. F. Challenger and J. B. Harrison. *J.I.P.T.*, 1935, **21**, 135–154.—An account of experiments of the synthesis of the isomeric thiophthens and some of their derivatives. G. R. N.

527. Higher Benzenoid Hydrocarbons. Syntheses with the Aid of Metallo Derivatives. H. F. Miller and G. B. Bachman. *J.A.C.S.*, 1935, **57**, 766–771.—In this work the preparations of the Grignard reagents of the most readily available bromo-derivatives of anthracene, phenanthrene, fluorene, and acenaphthene have been studied. Amongst the compounds synthesised are dihydroanthracene, 9-*n*-propyl-phenanthrene, 9-*n*-butylphenanthrene, bisdiphenylenethane, 9-*n*-butylfluorene and 9-*cyclo*hexylfluorene, etc. The results indicate that various solvents affect the equilibrium $2RMgX \rightleftharpoons R_2Mg + MgX_2$, and therefore influence the relative amounts of RMgX and R_2Mg present. It is proposed that the latter tends to react with alkyl halides to give coupling, whilst RMgX tends to give normal reaction. W. E. J. B.

528. Reaction between Oxygen and 2-Butene. H. J. Lucas, A. N. Prater, and R. E. Morris. *J.A.C.S.*, 1935, **57**, 723–727.—With the object of testing the oxidation mechanism of unsaturated hydrocarbons, the oxidation of 2-butene was examined. If hydroxylation takes place at either of the two unsaturated carbon atoms, methyl ethyl ketone would be a reaction product, whilst if oxidation occurs at both carbon atoms, dimethyl glycolic aldehyde or dimethyl glyoxal should result. When a mixture of 2-butene and oxygen, the former in excess, was passed through a pyrex tube at 375° to 490° C., the principal reaction products in all cases were acetaldehyde and butadiene. Less important products were glyoxal (or glycolic aldehyde), an olefin oxide, an acid, and some peroxide. At the higher temperatures, octene was formed by polymerisation. The Authors conclude that hydroxylation is not important, since no methyl ethyl ketone was formed. A probable reaction mechanism which assumes the formation of 2-butene peroxide is advanced. The peroxide decomposes to yield acetaldehyde, and other products are thought to result from a succession of reactions already known. W. E. J. B.

529. Isolation of a Nonanaphthene from an Oklahoma Petroleum. J. D. White and F. W. Rose, Jr. *Bur. Stand. J. Research*, 1934, **13**, 799–810.—A nonanaphthene of b. p. 136·65° C. has been isolated from an Oklahoma crude.

The petroleum was first systematically distilled and the aromatics removed from the fraction under consideration by liquid SO_2 and fuming sulphuric acid. Fractional crystallisation at first from solution in propane and methane, but afterwards in dichlorodifluoromethane, isolated the naphthene, which was examined for its b. p., freezing point, density, refractive index, heat of fusion, and aniline point.

Its empirical formula of C_9H_{18} has been established, and it is considered likely to be a derivative of *cyclo*pentane. [There is a possibility that it may be a mixture of stereoisomers.]

It is present to the extent of not more than 0·1% in the crude. D. L. S.

530. Polymerisation of Pentenes. H. I. Waterman, J. J. Leendertse, and W. M. Klazinga. *Rec. Trav. Chim.*, 1935, **54**, 79.—These investigations include experiments with *n*-2-pentene and with a mixture of branched pentenes, containing *iso*propylethylene mainly. In the first case a series of experiments was made at 0° C. using aluminium chloride as a catalyst. The method of analysis of the products obtained is similar to that described in previous communications. The A oil, representing about 80% of the total reaction product, had a cyclic structure and a high molecular weight. The B oil was not examined. It was striking that the aniline point determined for the hydrogenated fractions of the reaction product deviated from those predicted from the correlated specific refractivities and molecular weight for all fractions, possibly due to a particular structure for this series of polymers. Some chlorine was found to be present, determinated by the Carius method.

Experiments at 400° C. and a high pressure with and without alumina as a catalyst yielded polymers with a larger number of C atoms in ring structure than those obtained at low-temperature polymerisation and with the same molecular weight.

The experiments with branched pentenes were carried out at 85°, 200°, and 400° C. in an autoclave using aluminium chloride as a catalyst and a non-aromatic gasoline as a liquid diluent. A considerable amount of polymerisation was observed.

With another experiment at 400° C. and with alumina as a catalyst a product was produced which contained the dimer- and higher poly-merised compounds only; thus a non-destructive polymerisation had occurred. P. C. K.

531. Polymerisation of *cyclo*Hexene. H. I. Waterman, J. J. Leendertse, A. C. Ter Poorte. *Rec. Trav. Chim.*, 1935, **54**, 245.—*cyclo*Hexene prepared by the dehydration of *cyclo*hexanol in the presence of concentrated sulphuric acid, was polymerised with aluminium chloride as a catalyst using pentane as a liquid diluent at various temperatures. In the experiments below 40° C. scarcely any polymerisation was observed, but at 70° C. the reaction proceeded rather rapidly to form high molecular products.

The amount of B oil formed generally exceeded that of the A oil. The chemical structure was investigated with the methods of analysis described in this *Journal*, 1932, **18**, 735, by the comparison of different physical constants of the product and that after complete hydrogenation. It was shown that the specific refractivities of the saturated product obtained by complete hydrogenation of the *cyclo*hexene polymers are in agreement with the calculated values of *cyclo*hexyl compounds with the same molecular weight.

The B oil appeared to be more unsaturated than the A oil; the chlorine percentage of the B oil, however, was rather high (1·7%).

In the presence of both hydrogen chloride and aluminium chloride a rapid polymerisation also was obtained even at − 78° C., producing monochloro*cyclo*hexene and a mixture of monochloropoly*cyclo*hexyl compounds. P. C. K.

532. Polymerisation of *iso*Butene with Alumina on Silica-Gel as a Catalyst and the Addition of Hydrogen Chloride to the Reaction Products without a Catalyst. H. I. Waterman, J. J. Leendertse, and A. J. de Kok. *Rec. Trav. Chim.*, 1935, **53**, 1151.—*iso*Butene, prepared by dehydration of *iso*butyl alcohol with alumina as a catalyst, was polymerised in the vapour phase in the presence of alumina on an activated silica-gel at below 40° C.

The investigation of the reaction products was performed by the method of analysis customary in this laboratory. Dimer, trimer, and tetramer compounds were found, the trimer polymeride predominately. The physical constants of the separated polymers are generally in correspondence with the polymerisation products of other

investigators on this subject obtained by other methods of preparation. All polymer fractions are considered to be mono-olefinic, not cyclic. The polymers obtained under the conditions specified above were compared with those produced at low temperature (— 78° C.) with $AlCl_3$ as a catalyst and a liquid diluent, and with respect to their chemical structure the latter contained more C atoms in a nucleus form. It was possible to saturate the tri*iso*butene fraction at — 78° C. completely with hydrogen chloride and without a catalyst. The stability of the chloride produced is low. From this it might be explained that low, sometimes negative, bromine values are observed for polymerisation products. P. C. K.

533. Use of Physical Constants in the Determination of the Composition of Motor Fuels. M. Marder. *Oel u. Kohle*, 1935, **11**, 75–77. (*See also Abstr. No.* 426.)—The molecular refraction can be calculated either from the atom and bond increments or from the refractive index, the density and the mol. wt. $\left(R_M = \frac{n^2-1}{n^2+2} \cdot \frac{M}{D}\right)$. If the specific refraction $R_s\left(=\frac{n^2-1}{n^2+2} \cdot \frac{1}{D}\right)$ of hydrocarbons calculated by the first method is plotted against mol. wt., R_s for paraffins and *iso*paraffins lie on one curve, but R_s for unsaturated hydrocarbons lie on a series of curves according to the number of double bonds. Similarly for aromatics, the curves vary with the degree of hydrogenation. For single ring naphthenes R_s is independent of the mol. wt. and lies on a straight line parallel to the axis. Refractions of mixtures of unsaturateds and aromatics cannot be calculated from the increments, but mixtures of naphthenes and paraffins obey the mixture rule. The method is applied to the analysis of hydrocarbon mixtures after removal of the unsaturateds and aromatics by sulphuric acid. The proportion of paraffins is given by $x = 100\frac{(R_1 \cdot R_2 - R_1 \cdot R_2 \cdot)}{R_3(R_2 - R_1)}$ where R_1. R_2, and R_3 are the specific refractions of paraffins of mean mol. wt. M, naphthenes, and the gasoline, respectively. A simpler method of estimation employs the relation between R_s and boiling point of the hydrocarbons. Since all 1-ring naphthenes have the same R_s, it is possible to obtain the increase in refraction corresponding to 1% increase in paraffin content for a series of mean boiling points. A chart for the calculation is given analogous to that derived by Garner for the aniline point method (*J.I.P.T.*, 1928, **14**, 699). C. C.

534. Distillation Curves of the New Premium Fuels Show Unusual Characteristics. Anon. *Oil & Gas J.*, 7.2.35, **33** (38), 41.—This winter three major companies have introduced "aviation type" premium fuels which differ appreciably in distillation range from each other and from the normal type of premium fuel sold. These variations indicate wide differences in opinion in regard to desirable properties of premium fuels. The principal features of the analyses as compared with those of an average of twelve ordinary premium gasolines are :—

Gasoline.	Ordinary.	A.	B.	C.
I.B.Pt., ° F.	94	88	95	93
10% over, ° F.	132	129	145	110
20% over, ° F.	157	151	168	116
50% over, ° F.	225	202	223	138
90% over, ° F.	338	278	315	240
E.P., ° F.	392	333	387	385
Recovery %	96·9	96	97	97
Reid V.P. lbs.	9·6	9·9	8·4	12
Octane No.	75	78	77	76

(Intermediate percentages estimated for A and B from data given.)

Sample C thus represents the greatest departure from present type premium fuels. R. A. E.

535. Determination of Small Amounts of Sulphur in Certain Organic Compounds. N. Strafford and H. Crossley. *Analyst*, 1935, **60**, 163–169.—A method and apparatus have been developed more particularly for determining sulphur in nitrobenzene, but

applicable also to other organic compounds, *e.g.* benzene, naphthalene, etc. Some hydrocarbons and solid materials are dissolved in nitrobenzene of known sulphur content to facilitate vaporisation. The material is vaporised in a spraying apparatus in which spray is produced by a jet of purified air blown across the orifice of a narrow tube dipping into the liquid. The mixture of vapour and air passes through a heated silica tube packed with platinised quartz. The oxidised products pass first through a water-cooled condenser and then through three absorption bottles containing 3% sodium peroxide. The sulphate formed is precipitated as barium sulphate. C. C.

536. Evaluating Soluble Cutting Oils. Anon. *Olii Min.*, 1935, **13**, 18–19.—Practical tests suggested include drilling a block or plate of steel under specified conditions and measuring the temperature developed, the consumption of emulsion, condition of the drill, etc. The stability of the emulsions when diluted with water should be examined over a number of days. Access of air tends to decompose the emulsion. In those cases where ammonium soaps or alcohol are present, decomposition is facilitated. Loss of ammonia during use (which may cause objectionable frothing and thereby restrict flow) may liberate free fatty acid which may have both oxidising and corrosive effects. An excess of alkali, however, is equally corrosive. Alcohol readily oxidises to acetic acid, which again facilitates rusting. Corrosive tendencies are tested by immersing cast iron in the emulsion. C. C.

537. Sludge Formation in Mineral Oils. H. Schwarz. *Petr. Zeit.*, 13.3.35, **31**, 7–8.—The Author summarises the work of Vellinger and Müller of Strasburg on this subject. The catalytic effect of copper on transformer oils was investigated. Curves are given showing the relationship between the weight of sludge formed as a function of the heating time at 110° using quantities of copper stearate varying from 2 to 25 mgm./100 ml. of oil heated. The effect of polarised copper of 10 cm.² surface area was also investigated.

The results showed that the quantity of sludge formed was proportional to the heating time and to the quantity of copper dissolved in the oil. W. S. E. C.

538. Laboratory Examination of Road Emulsions. H. Kleinert. *Asphalt u. Teer*, 1935, **35**, 194–199.—An account is given of the methods used in the Technical Institute of Road Construction, Dresden. It is considered that test samples should be stored in glass containers and not in tinned or galvanised vessels. Emulsions should be tested for alkalinity—normal samples should show an alkaline reaction. For the sieve test, both 100- and 900-mesh sieves have been used, but an emulsion which shows no residue on the 100 sieve will be satisfactory in practice, since it will easily pass the nozzle of the sprayer. Viscosity is determined on the Engler at 20° C.—emulsions for surface dressing should have a higher viscosity than penetration emulsions. For the former type, it is suggested that the English specification for the upper limit of viscosity is too low (4–15°). Microscopical examination is carried out on emulsions diluted with 3 vols. of 2% potash. The water content is determined by distillation of a benzole solution to which barium chloride has been added. To avoid errors due to condensation of moisture from the air, a device is fitted whereby contact with the air is made through calcium chloride. A comparison is given of methods of recovering the bitumen. The Author favours evaporation of the benzole after filtering or centrifuging the solution from the water estimation. In all the methods, the penetration of the recovered bitumen is much less than that of the original. Resistance to freezing is investigated using a 50-ml. stoppered cylinder as container, sieving the emulsion after 1 hr. at − 8° C. The Weber/Bechler method for breakdown and the Weber/Riedel method for adhesivity are preferred. The adoption of the lability test is considered to be premature. C. C.

539. Structure of Cold-Asphalt. E. H. Kadmer. *Asphalt u. Teer*, 1935, **35**, 167–170.—A survey is given of the nature of the constituents of asphalt emulsions (including the emulsifiers and stabilisers) and also of methods of manufacture. A number of patents are reviewed, including the use of triethanolamine, ammonium linoleate, etc., as emulsifiers. Brief reference is made to the breakdown of emulsions and of the relation between stone and emulsion as affecting the application of the latter.

C. C.

540. Patents on Analysis. W. J. Willenborg, E.P. 424,053, 11.2.35.—A method of analysing gases by differential thermal conductivity measurements. The apparatus comprises a plurality of thermal conductivity cells which are differentially compared. Conduits are provided for simultaneously withdrawing samples of the gas mixture to each of the cells, the flow in each conduit being co-ordinated by means of flow meters. The measuring instrument used is a Wheatstone Bridge, the cells being connected to different legs of the bridge circuit. W. H. T.

Class 600. Refining and Refineries.

541. Chemistry and Refining of Petroleum. H. P. Rue and H. M. Smith. *B. of Mines Minerals Year Book*, 1934, pp. 691–706.—A *résumé*, with copious references, is given of the outstanding developments in the fields of chemistry and refining of petroleum for the year 1933. C. L. G.

542. Developments in Petroleum Refining Engineering in 1934. W. Miller. *Refiner*, 1935, **14**, 90–91.—There was a continuation in the direction of integrated skimming and cracking units, evidenced by the completion of 30 and 20,000 brl. units. A reduction in the cost of ethyl lead, coupled with a slowing up of the trend towards higher octane gasoline, lessened interest in reforming. Considerable interest, however, was shown in the cracking and polymerisation of refinery gases to high octane motor fuel. Yields of stable and high anti-knock product ranging from 2 to 8 gallons per 1000 cu. ft. are reported, but opinion differs as to the economic feasibility of the conversion.

The problem of preparing acceptable Diesel fuels received considerable attention, although specifications of ideal fuels have not as yet been drawn. Expanded use of various solvents in the extraction and refining of lubricating oil is notable. Extraction plants having a combined daily capacity of 30,000 brl. of finished oils were completed during the year, and others are under construction or contemplated. There is an increasing trend in automobile manufacturing towards designs requiring lower viscosity lubricants. Existing prejudices against the use of thin-looking oils are disappearing rapidly. Compounding for the improvement of oiliness, bearing load capacity, and general stability attracts general interest.

Good progress is reported by committees along the lines of standardization of refinery equipment, fire and accident prevention, etc. B. C. A.

543. 3600-Barrel Pressed Distillate Rerun Unit. W. T. Ziegenhain. *Oil & Gas J.*, 7.2.35, **33** (38), 35.—A new Foster Wheeler pressed distillate atmospheric re-run unit has been installed at the W. Tulsa refinery, and occupies one-tenth of the space taken by the 20-shell stills which it replaces. The plant was designed to fractionate the pressed distillate (80 secs. visc.) into three grades of raw-neutral oils (110, 220, and 330 secs. visc.), gas oil and the two lighter neutrals being taken as side streams from the tower. The oil leaves the heater at 685–700° F. and enters the fractionating tower at a point one-third of the way up from the base. Internal stripping sections are provided and the tower is supplied with superheated steam. Reflux control valves operate between the stripping sections permitting adjustment of rate of reflux as required, thus maintaining constant specification of products regardless of rate of throughput. Control is so centralised that the turning of one key adjusts fuel supply to furnace, reflux over tower and quantity of side cuts removed, to the requirements of a change in rate of charge. Should the normal supply of oil not reach the furnace, the operators are automatically warned and the fuel supply to the furnace is cut off. Fuel consumption including that used for raising steam amounts to 1·9–2·0% of intake. R. A. E.

544. Refining Operations in Pechelbronn Area. Anon. *Oil & Gas J.*, 21.2.35, **33** (40), 83.—The Pechelbronn field has been operated since 1768, and a brief outline of its history to date is given. The concession of the operating company covers 18,000 acres, and the total production is approx. 1500 brl. a day. Part of the production comes from several hundred pumping wells, and the remainder from mining operations which have been previously described.

The crude from the two sources vary slightly, but representative yields are: Gasoline 8·7%, kerosine 20%, gas oil 8%, lubricating stock 40%, pitch and coke 14%, remainder fuel and loss. The domestic supply is supplemented by 600 brl. a

day of imported crude, which is transported part of the way by lighter and then transferred to tank cars. The refinery is divided into three distinct sections. In the first or " lampert-slock " section, the domestic crude is topped in coal-fired stills at atmos. pressure to a 65% residue, the gasoline and kerosine produced being refined, and if necessary redistilled in batch stills for special products. The capacity of the stills is 1400–1500 brl. a day, and a Wolf-Carburol cracking plant is provided to crack the gas oil with a yield of 63% semi-refined gasoline, and 22% residue of low viscosity. Shipment of white products and fuel is dealt with in this section. The second or " Merkwiller " section treats the 65% residue for extraction of lubricating oils in twenty-two vacuum stills of 40 cu. m. capacity each, under a vacuum of 60 cm. mercury. This section also refines the lubricating oils, extracts and refines paraffin wax, redistils petroleum pitch to coke, and attends to shipment of all products other than white oils and fuels. The coke is manufactured in small hemispherical stills. In the third or " Kutzenhausen " section, which is the most modern, the refining of imported oils takes place. The stills are heated by fuel or pulverised coal and the capacity is 750 brl. a day. In addition, there is a central plant to supply steam and electric current.

The asphalt from the lubricating oil plant is partly used in the preparation of road emulsions, for which suitable plant is available. All shipments of refined products are made by rail or by road. R. A. E.

545. Large Stripping Tower in Operation in California. J. C. Albright. *Nat. Pet. News*, 6.2.35, **27** (6), 20. F.—The tower is 110 ft. high with an internal diameter of 7 ft., and is fitted with thirty-eight bubble trays and three draw-off pans. It is surmounted by a South-western double reflux condenser, which is cooled by crude oil by-passed from the charging stock. The tower produces five fractions : gasoline, end-point 375° F. ; naphtha, end-point 442° F. ; kerosine, end-point 525° F. ; gas or Diesel oil, end-point 670° F. ; and a residuum consisting of fuel oil with a viscosity Saybolt Furol of 80 secs. at 122° F. A sixth product in the form of a light gasoline, end-point 365° F., is obtained by heat exchange before the charge reaches the main tower. The bubble caps are of peculiar design, resembling eight-petalled flowers. They have saw-tooth-shaped slots, are 4½ in. high, and are bolted down over vapour nipples made from 4 in. O.D. 10-gauge steel boiler tubes. The nipples extend 2-$\frac{7}{8}$ in. from the surface of the plates. The plates are welded to the sides of the column and, with the exception of the three draw-off pans, each has a down spout containing 504 sq. in., which extends to within 2 in. of the next pan below. The weirs project 3½ in. above the surface of the plates. The overhead product, refluxed to a temperature of 280° F., is removed and condensed in shell and tube units. In amount it represents 21% of the crude processed. The naphtha cut is drawn off from the tenth plate down. A small amount of steam is admitted to the draw-off pan to complete stripping. A temperature of 370° F. is maintained on this plate. Kerosine is removed from the fourteenth plate down. Gas oil is drawn off at 450° F. from the tenth plate up. Steam is used on this pan. The bottom in the column below the stripping plate is agitated by live steam. H. G.

546. Distillation and Absorption in Packed Columns. T. H. Chilton and A. P. Colburn. *Ind. Eng. Chem.*, 1935, **27**, 255.—The Authors show that the difficulty of separation in a packed column may be expressed as the number of " transfer units " necessary to effect separation. The number of transfer units is defined as :—

$$n = \int_{p_1}^{p_2} \frac{dp}{\Delta p}$$

for distillation, and :—

$$n = \int_{p_1}^{p_2} \frac{dp}{\Delta p} \left(\frac{p_{g'}}{p_g} \right)$$

for absorption.

p_1 and p_2 = partial pressure of the diffusing component at ends of the column.
$\Delta p = p - p^*$
p = partial pressure of component at any point in column.

p^* = partial pressure of component in vapour in equilibrium with liquid at the same point in the column.
p = partial pressure of inert component.
p_{gl} = log. mean of $\pi - p$ and $\pi - p^*$.
π = total pressure.

These equations are derived by considering the mass transfer of the diffusing component

The method of working out the number of transfer units for cases of distillation of a binary mixture, and the absorption of a single component in a mixture with an inert gas are given.

The efficiency of a column can then be expressed as the " height of a transfer unit " (H.T.U.), instead of " height equivalent to a theoretical plate " (H.E.T.P.).

It is shown that for many cases of distillation the H.E.T.P. and H.T.U. are nearly identical, but that there may be large differences between them for certain absorption problems. P. D.

547. New Design Calculation for Multi-component Rectification. E. R. Gilliland. *Ind. Eng. Chem.*, 1935, **27**, 260.—The proposed method of design is based upon the relative volatility of the components of the mixtures, and for the case of infinite reflux reduces to Underwood's modification of Fenske's relative volatility system. For the case where separation between adjacent components is not relatively complete the determination of suitable design conditions by previous design methods has been tedious. The proposed method is useful in determining the proper design conditions, such as dependent terminal concentrations and the number of equilibrium plates. The method of application is illustrated by two problems. P. D.

548. Entrainment in Plate Columns. T. K. Sherwood and F. J. Jenny. *Ind. Eng. Chem.*, 1935, **27**, 265.—Data are presented on the entrainment using air and water in a two-plate bubble-cap column. The column was 46 cm. in diameter, and the arrangements were such that liquid height, plate spacing, type, and number of bubble caps, and fluid velocity could all be varied. The results which show the effect of these variables on the entrainment are presented in tabular and graphical form, and are compared with those of other observers.

Data were also collected on the pressure drop across the plates.

The effect of entrainment on the appearance of non-volatile impurity in the distillate, and on rectification is analysed. P. D.

549. Effect of Entrainment on Plate Efficiency in Rectification. F. H. Rhodes. *Ind. Eng. Chem.*, 1935, **27**, 272.—Certain parts of the former article on this subject by the same Author (*Ind. Eng. Chem.*, **26**, 1333) were discussed so briefly that they were not clear. A more detailed discussion of the estimation of the effect of entrainment is given in this article. Several errors in the original article are noted and corrected. P. D.

550. Efficiency of Petroleum Fractionating Columns (Part II). V. W. Garton and R. L. Huntington. *Refiner*, 1935, **14**, 60–62.—The results secured from the operation of an atmospheric bubble tower of 3 ft. diameter and 90 ft. height, located in the Petroleum Engineering Laboratories of the University of Oklahoma, have been analysed in regard to the efficiency of separation of the gasoline and kerosine streams therein. This was effected by the determination of the T.B.P. curves of the products, and the application of the McCabe–Thiele diagram. It was found that the order of magnitude of the efficiency of the kerosine–gasoline section of the column is in line with the efficiency of separation of known mixtures in commercial towers of similar design. B. C. A.

551. Relative Efficiencies of Packed Fractionating Columns. P. Docksey and C. J. May. *J.I.P.T.*, 1935, **21**, 176–199.—An article giving a derivation of equations from which the relative efficiencies of columns packed with material of any given shape may be calculated together with an account of some experiments with binary mixtures the results of which tend to support these equations. G. R. N.

552. Cracking Rumanian Oils. G. Egloff. *Petr. Times*, 1935, **33**, 217.—The article is a comprehensive survey of the properties of the principal Rumanian Crude Oils

and the products from them. The information is given in concise tabular form. The most important producing fields are those of Gura Ocnitzie, Boldesti, Moreni, Ochiuri, Ceptura, Piscuri, Runcu-Scorteni, and Chiciura. Rumanian oils make excellent cracking stocks and produce high yields of high anti-knock gasoline. Topped Moreni and Gura Ocnitzie crudes have been cracked in a pilot plant operating on the Dubbs principle. The equipment consisted of a furnace, reaction chamber, flash chamber, fractionating column, condensers, and receivers. The charging stock plus heavy reflux passes, under pressure, through the furnace to the reaction chamber, thence to the flash chamber under reduced pressure; overhead vapours pass to the column, the residuum being withdrawn continuously. The yields are given as a percentage of the topped crude as follows: Moreni Crude—gasoline 50·5%, residuum 35·3%, gas and loss 14·2%; Gura Ocnitzie Crude—gasoline 61·3%, residuum 25·8%, gas and loss 12·9%. The gasolines, after acid refining, have the following properties:—Moreni—gum 2·8 mg./100 ml. (C.D.), octane number (motor method) 70, E.P. 346° F. Gura Ocnitzie—gum 11 mg./100 ml. (C.D.), octane number 70, E.P. 370° F. The residuum conforms, at least to bunker C fuel oil specification. The total yields from the two crudes are given as follows:—

	Moreni.	Gura Ocnitzie.
Straight-run gasoline	29·3%	28·7%
Cracked gasoline	32·4%	38·9%
White spirit	5·7%	7·2%
Cracked residuum	22·7%	16·4%
Gas and loss	9·9%	8·8%

The total estimated production of crude in Rumania during 1934 was 4% of the total world production. H. G.

553. Velocity and Heat of Reaction of Cracking. E. Lederer. *Petr. Zeit.*, 20.3.35, **31**, 1–2.—The velocity of cracking is represented by the equation $\log. K = -q/RT + C$, where R is the gas constant, q the molecular heat of reaction, and C a conventional constant. When ordinary logarithms are applied, the factor 4·571 displaces R and q is then calculated in gm.-cals. The velocity is defined as that point at which the limiting yield of cracked benzine is formed under conditions of equilibrium, since this is independent of the temperature. The Authors have determined this velocity in cracking first paraffin at 450° under reduced temperature and 10 atmospheres pressure, and then mazout at 425° and 15 atmospheres pressure, the limiting yields of benzine being 47% and 54%, respectively. A value of 65,800 cal./mol. has been obtained for q.

The Authors conclude that the heat of reaction of cracking is approximately twice that of the molecular heat of cohesion, or one and a half times the heat of sublimation. W. S. E. C.

554. Initial Operation of Dubbs Cracking Installation. W. T. Ziegenhain. *Oil & Gas J.*, 21.2.35, **33** (40), 12.—A Dubbs cracking plant has recently been installed at a Cushing, Oklahoma, refinery, to process all the residuum from the topping units. The plant is of conventional type, consisting of reaction and flash towers, one feature of the installation being a dual side-fired Alcorn furnace, that provides unusual flexibility in equalising the effect of changing the type of charging stocks, charging rate, etc.

The unit has recently been operated on gas oil, making 68·5% of 400 E.Pt. gasoline, 17·92% of fuel oil, with 9·90% uncondensed gas and 3·60% coke and losses. The gasoline has the following properties: gravity 58·0° A.P.I., I.B.Pt. 78° F., E.Pt. 392° F., 10%, 20%, 50%, and 90% dist., respectively, to 134°, 182°, 276°, and 382° F.; octane number 68. The fuel oil has the following properties: gravity 8° A.P.I., viscosity at 122° F. S.U. 108 sec., flash point 140° F. and B.S. & W. 0·8%.

When running topped crude of gravity 27, a yield of 50·5% of 390° E.Pt. gasoline (excluding about 5% light fractions obtained from the vapour recovery unit) of the following characteristics is obtained: gravity 60·3° A.P.I., I.B.Pt. 80° F., E.Pt. 386° F., 10%, 20%, 50%, and 90% dist., respectively, to 128°, 164°, 264°, 368° F.; octane number 68–69; gum content 39 mgms.

A flow sheet, operating details and general constructional details of the unit are given. C. L. G.

555. Clark Vapour Phase Cracking Process. J. C. Albright. *Refiner*, 1935, **14**, 143–146.—A unit of the Lincoln Clark Vapour Phase Process was placed in operation in the plant of Rice Ranch Oil Co. at Santa Maria, California, late in 1934. From the topping section of the unit a gas-oil stream is secured consisting of all fractions between residuum and gasoline, which cut is passed to a tubular heater. After passage through a first bank the heated gas oil passes to a flash drum, the vapours from which pass to the second bank of the heater, which serves as a vapour superheater. The superheated gas-oil vapours are led to a horizontal combustion chamber, where they are further heated by contact with the hot gases from an oil or gas burner, the flame of which is so regulated as to be non-coking and free from excess oxygen.

The temperature of the gases of combustion at the point where the superheated vapours enter is maintained at 1010° F. The mixed gases pass then to a reactor and rectifier.

Topped crude 14·3° A.P.I. yielded 23% gasoline 47·1° A.P.I., 70·8% residuum of 10·3° A.P.I., and 6·2% gas and loss, in cycles limited to 21 days for reasons of inspection. Coke is not deposited in the reactor, and this absence of coke formation is desirable, as the bottoms are utilised as road material. B. C. A.

556. Hydrogenation of Naphthalene. A. Maillard. *Ann. des Comb. Liq.*, 1934, **9**, 1013–1070; 1935, **10**, 95–139.—The Author has studied the hydrogenation of naphthalene and tetralin, as well as the dehydrogenation of tetralin and decalin, between room temperature and 180° C. Most of the work has been effected in the presence of reduced nickel supported on pumice. The data presented are comprehensive and illustrated with many graphs. Equilibrium constants, dissociation pressures, etc., have been determined. A comprehensive summary is appended in which the Author lists the reactions which do, and do not, occur in the temperature range investigated. W. E. J. B.

557. Hydrogenation of Bituminous Coal. M. Pier. *J.S.C.I.*, 1935, **54**, 284–288.—This paper is prefaced by an introduction by K. Gordon in which it is stated that, at the present time, the vapour-phase units of the Billingham plant of I.C.I. are manufacturing petrol from creosote oil.

The actual paper contains considerable references to results obtained with brown coal at Leuna by the I.G., where, by the end of 1935, it is expected that the petrol output will have risen to 300,000 tons a year, obtained by direct hydrogenation of brown coal. The Author reviews the development of successful processes with attention being given to production of the necessary steels and catalysts, whilst various difficulties, eventually overcome, are discussed. A three months' run was made in late 1934 on a plant capable of treating 20 tons of bituminous coal a day. Briefly the process described consists of making an oil and coal paste to which is added a catalyst-oil paste; the mixture containing 50–60% solids being readily pumpable. This paste is compressed to 300 atmospheres, hydrogen added, preheated to 410° C., and passed to two converters in series. The temperature in the first converter rises to about 460° C., and conversion of the coal to middle oil and petrol together with some gaseous hydrocarbons occurs, and is completed in the second converter. The separation of liquid products is described, which yield eventually a petrol cut (at 170° C.), a middle oil cut (boiling up to 325° C.), and a heavy oil. The latter is used as pasting oil for new coal, whilst the former two represent practically all the new oil formed from coal. The middle oil is converted to petrol in the vapour phase using a static catalyst. The final finished petrol is stated to have an octane number of 66–68 and a good lead response. No yield figures are given.

Phenols, cresols, etc., can be separated from the petrol and middle oil fractions and worked up as pure products.

The paper concludes with listing the products now being made from coal, *e.g.* brown coal to lubricating oil via brown coal heavy oil, and with a comparison of brown and bituminous coal. The former is of particular importance for products rich in hydrogen, and the latter for products poor in hydrogen. The Author con-

siders that there are to-day no technical difficulties in hydrogenating bituminous coal. W. E. J. B.

558. New Benzole Washer. K. Eming and J. F. Kesper. *Teer u. Bitumen*, 1935, **33**, 64–66.—The article describes a new type of benzole washer, which consists of a large cylindrical tank, to the bottom of which a smaller cylinder is attached and in which the acid collects. Benzole is sucked from the top of the tank and pumped to the bottom of the attached cylinder through a vertical axial pipe, the bottom of which is fitted with a special distributor which imparts a circulating motion to the subdivided benzole. A system of vertical vane partitions is arranged at the bottom of the large tank, and these assist in separating the acid and benzole.

W. E. J. B.

559. Manufacture of Motor Fuels from Brown-Coal Tars by Cracking under Pressure. K. Kohlhardt. *Oel u. Kohle*, 1935, **11**, 80–83.—Most brown-coal tars from Middle Germany are suitable for the production of motor fuels by cracking under pressure, but the tar must be freed from mechanical impurities, particularly water, whilst the sulphur content should not exceed 2·5%, creosote content not above 22%, and asphalt (by the petroleum spirit method) not above 3%. The type of cracking plant is important, since petroleum distillates, and these tars differ in their behaviour under thermal treatment. The use of a reaction chamber is not recommended with tars owing to severe coke formation. A minimum rate of flow must be maintained, and the heating and time of reaction carefully controlled. The crude gasoline formed contains some 8% of tar acids or creosote, which must be removed by washing with caustic soda. Phenol and cresols are recovered. The gasoline is finally refined by acid and plumbite treatment. Pitch obtained as a by-product is suitable for briquetting, whilst the gases from the cracking process have a gross calorific value of 10,000–11,000 kg.-cals. and have a number of industrial uses, *e.g.* as town gas, as motor fuel, for the preparation of alcohols, etc. In an example quoted, a tar gave 35·2% (by weight) of gasoline, although in a footnote it is suggested that the operating conditions could be modified to give tractor and Diesel oils as the main products. C. C.

560. Girbotol Purification Process. R. R. Bottoms and W. R. Wood. *Refiner*, 1935, **14**, 105–107.—Separation of hydrogen sulphide or carbon dioxide from gas mixtures is accomplished by the Girbotol process (patented), which employs organic bases, amines, as absorbing agents, by taking advantage of the facts that while aliphatic amines have a strong affinity for acid gases at or near atmospheric temperature, expulsion of the gases occurs at higher temperatures. An installation of the process for washing carbon dioxide out of 7,500,000 cu. ft. of hydrogen has been in successful operation since 1931. B. C. A.

561. Refining of Motor Benzole. The Instill Process. *Gas World*, 1935, **102**, 15–17, 41–43.—Manufacturers of motor benzoles are using a selective method of refining such as the Instill process, instead of the strong acid washing formerly applied. Changes in specifications now permit the acceptance of "stable motor spirits" which do not pass the acid washing test, but which must pass an oxidation test. The Instill process can refine crude benzole (from coking plants and town gas plants), cracked spirits, low-temperature oil, shale oil, and miscellaneous crude spirits. Crude benzole after once running is freed from bases (if required) by a suitable acid wash and is then neutralised.

The base-free crude benzole is then treated by the Instill medium by either the washer or percolator methods, a brief description with diagrams being given of both methods. The product is then distilled. Various advantages are given of the percolator method over the washer method; these include economy in medium required, equal results being obtained by using 50–66% of the medium required in the washer method. The gumming constituents and various sulphur impurities in crude benzole and their removal are discussed. Satisfactory removal of carbon disulphide is effected by agitation for 8 hrs. at 60° C. with an aqueous solution of sodium sulphide. A treatment of benzole forerunnings by this method gave a reduction of carbon disulphide from 7·22% to 0·01%. The Instill refining medium consists of ferric sulphate, absorbent earth, and free sulphuric acid, of which the ferric sulphate is the chief refining agent, the reactions of which are acidic, oxidising, and catalytic. The necessity of removing the pyridene before treatment by the

medium is stressed, because double salts are formed from the pyridene and sulphate of iron, which are useless as refining agents and would clog the medium.

Products obtained by the Instill process are compared with those from acid washing. The advantages claimed for the former products include freedom from sulphur and gum, good odour and colour, easier starting and acceleration, greater pulling power and mileage. Various charts are given, and reference is made to costs and plant working. W. A. W.

562. Technical Control of Percolation Filtration. S. R. Funsten and H. L. King. *Refiner*, 1935, **14**, 107–110.—It has been found that the presence of 3·0–5·0% of volatile matter in decolorising clay as determined by ignition for 30 minutes at 1800° F. is associated with maximum absorption, and that in burning actual clay temperatures in excess of 1100° F. or exposure to gas temperatures of above 1300° F. results in a loss of clay efficiency in subsequent reburnings. The maintenance of new clay at 850–900° F. for 15 minutes results in the best operation. Overburning which results in destruction of the adsorbent structure may be guarded against by tests for volume weight and volatile matter. The burning equipment should be indirect fired. B. C. A.

563. Synthesis of Fuels and Lubricating Oils from Carbon Monoxide and Hydrogen. F. Fischer. *Oel u. Kohle*, 1935, **11**, 120–123.—The hydrogenation of carbon monoxide in the presence of cobalt, nickel, and iron catalysts is first discussed. The optimum reaction temperature for the first two catalysts is 180–200° and for iron 230–250°; lower temperatures are required when the concentration of hydrogen is high. The heat of reaction, unless controlled, favours the production of methane. A mixture of carbon monoxide and hydrogen is obtained in the gasification of coke. To give a maximum yield of liquid products, the relative proportion of the above two gases should be 1 : 2. Such a mixture is obtained by gasifying at lower temperatures using more steam. The mixed gases, freed from sulphur, are brought into contact with the catalyst under suitable conditions, and about 100/120 grammes of liquid hydrocarbons (Kogasin) are formed per cu. metre of gas. The fraction (end-point about 200°) termed Kogasin I is of low octane number (47). The fraction boiling above 200° (Kogasin II) contains wax, and after removal of the latter would form a satisfactory Diesel fuel. The separated wax has a melting point 50–60°.

From the Kogasin, valuable secondary products can be obtained. Cracking Kogasin II gives a higher yield of low-boiling constituents of high octane number. Alcohols may be obtained indirectly from the unsaturated hydrocarbons. No lubricating oils occur naturally in Kogasin, but they may be synthesised by a number of processes, including condensing the fraction rich in olefines with aluminium chloride, and chlorinating high-boiling fractions and condensing the product with activated aluminium or aromatic hydrocarbons. The oils formed are resistant to oxidation, of low carbon residue, and of low pour point. C. C.

564. Method of Blending Petroleum Products, especially Lubricating Oils. M. Partiot. *Refiner*, 1935, **14**, 73–76.—Describes a proprietary blending machine known as the Automixer, invented and developed in France by Paul Thiberge of the Les Consommateurs de Petrole, Paris. The device permits drawing continuously from the stock tanks, base oils in the right proportion, continuous mixing in the same proportions without application of heat, and delivery of the blends directly into containers for immediate shipment or delivery, by a purely mechanical method. B. C. A.

565. Manufacture, Packaging, and Shipping of Oxidised Asphalt. (Article 1.) C. J. Holland. *Petr. Eng.*, Feb. 1935, **6** (5), 33.—In the introduction to a series of articles on this subject, reference is made to the lack of attention paid to the manufacture and marketing of petroleum coke and of oxidised asphalts. The market for coke is limited, and generally at a prohibitive distance from the refinery, so that it is generally allowed to accumulate. There is, however, a market for it in Europe for metallurgical and electrical purposes. The objections generally raised against the manufacture of oxidised asphalt are that it is dirty and costly to make, specifications are too variable and difficult to meet, complaints are overwhelming, batch production is necessary, etc. It is pointed out, however, that the market for asphalt for industrial and pavement purposes has only been touched. The production of

oxidised asphalt has decreased in the last 2 years, owing to the customers building their own oxidising plants, and to the setting of specifications which eliminate blown asphalt. It is pointed out, however, that an efficient continuously operated oxidising plant is cheaper to operate than a steam-distilled asphalt plant. The total costs for air, steam, and fuel should be about 5 c. per ton of asphalt. Steam distilled asphalt costs 2–3 times as much, whilst throughput is much reduced. Reference is made to the pioneer work of Maberg and Byerly on the oxidation of Ohio Residue and to the chemical reactions involved in the oxidation of asphalt. Oxidation differs from distillation in that increase in the oxygen content with consequent formation of acids does not occur. The Br value and N content increase with little difference in the percentage of sulphur. Polymerisation as well as oxidation must therefore occur.

The trend of consumption and sales statistics in the U.S.A. for 1932–33 is discussed.
C. L. G.

566. Manufacture, Packaging, and Shipping of Oxidised Asphalts. (Article 2.) C. J. Holland. *Petr. Eng.*, March 1935, **6** (6), 45.—A description is given of the first continuously-operated asphalt oxidising plant built in 1916 and designed by the Author. Prior to 1916 a batch of sixteen oxidising stills were in existence, and these were redesigned to form two continuous batteries of eight still each, giving a capacity double that of the batch stills with greatly reduced operating and maintenance costs and better products. Continuous oxidising plants built since this date have improved very little on the fundamental features of the original plant.

Four grades of oxidised asphalts were prepared from a Texas residue. These had the following characteristics :—

Grade A.	M.Pt. 168° F.	Pen. at 25° C.	31
Grade B.	,, 229° F.	,,	14
Grade C.	,, 254° F.	,,	10
Grade E.	,, 296° F.	,,	6

A description is given of the plant layout, drum factory, vapour disposal system, and of the method used for coke removal from the vapour line. C. L. G.

567. Gard-Aldridge Asphalt Process. R. T. Howes and C. N. Whitaker. *Refiner*, 1935, **14**, 102–104.—Claiming the average consumption of air in the conventional air-blowing process is 6000 cu. ft. per brl., and that the corresponding quantity in the present process is less than 1500 cu. ft., the above proprietary process is stated to consist essentially of the intimate mixing of air and stock at a suitable temperature, obtained by the circulation of large volumes of hot stock into which an economical amount of air is introduced. Cooling facilities are provided for regulating the temperature of the charge, which enables advantage to be taken of the more rapid oxidation rate obtainable at higher temperatures. Greatly reduced running time and superior character of finished product are claimed. B. C. A.

568. Manufacture of Asphalt Products from Santa Maria Crudes. Anon. *Refiner*, 1935, **14**, 63–66.—Describes the utilisation of a 8 A.P.I. crude oil containing 84% of 80 penetration asphalt and 16% lighter products. This heavy oil comes from a light grey shale and is free of paraffin wax. It is pumped with conventional equipment, but as it congeals on exposure to atmosphere, about 1 part of kerosine to 2 parts of oil is injected into the pumped stream at the casing-head. The oil coming from the producing zone contains about 15% of water, and this breaks out readily on heating before passage to the stills. The crude is processed to specification asphalt as bottoms. B. C. A.

569. Low Carbon Needed in Heavy Duty Refinery Alloys. Anon. *Nat. Petr. News*, 27.2.35, **27** (9), 30.—The article is a *résumé* of the annual meeting of the Petroleum and Metals divisions of the A.I.M.M.E. It was suggested that refinery castings should contain not more than 0·6% carbon, and that the addition of MO, W, and Mg was not beneficial. Castings containing a minimum of 24% Cr and about 10–12% Ni were recommended for maximum oxidation resistance and long service. For service in high sulphur conditions alloys containing 28% Cr were suggested, whilst for pyrometer wells exposed to high sulphur gases the Cr content should be at least 30%. Present laboratory tests were criticised on the ground that they are not always criteria of behaviour in practice. A series of corrosion tests carried out on

test strips under service conditions showed that corrosion proceeded rapidly at first and then more slowly, owing to the insulating effect of the corroded layer. These tests confirmed that resistance to corrosion in chrome/nickel alloys increases with decrease in C content. Exposure in 5% HCl indicated that high copper/low zinc alloys were definitely resistant, and that alloy cast iron was better than plain cast iron. H. G.

570. Practical Considerations for Refinery Pump Selections. L. D. Wyant. *Refiner*, 1935, **14**, 53–59.—Discusses in detail the selection of refinery pumps from the viewpoint of a refinery operator. Classifying pumps under positive displacement and centrifugal types, the Author details the outstanding characteristics and disadvantages appertaining to the various classes, and gives suggestions as to their operation in order to secure the best results. B. C. A.

571. Progress in Metallurgy as Applied to Petroleum Refining. R. L. Duff. *Refiner*, 1935, **14**, 88–89.—Few new alloys of consequence have appeared. Most attention has been given to ferrous alloys, although there has been some interest in hard brasses, bronzes, and copper alloys for non-sparking tools. One of the best alloys, viz. 18% chromium, 8% nickel, should not be used with an acid fuel or where more than one acid is present. Substitute cheap alloys are on the market, but after passing 1000° F. lose strength rapidly and oxidise very quickly. Another substitute, metal-clad material, is being used to some extent. It consists of a common steel with a veneer of lead, nickel, copper, monel of 18/8 alloy of varying thickness. B. C. A.

572. Inspection of Oil Refinery Equipment. F. L. Newcomb. *Refinery*, 1935, **14**, 92–97.—The first of a projected series of five articles covering scope of inspection, organisation of inspection forces, methods of conducting inspections, records required and their utility, limits of discarding equipment and results of systematic inspection. The present contribution details the equipment requiring inspection, and discusses the factors affecting the frequency of inspection together with the parts of equipment requiring the same. The organisation of an inspection force is outlined.
B. C. A.

573. Patents on Refinery Plant. O. D. Lucas and E. J. Lush. U.S.P. 1,990,608, 12.2.35. Apparatus for use in refining vapours and extracting undesired matter. It comprises a casing for holding a granular adsorbent material through which the vapours are passed. In order to maintain the adsorbent material at uniform temperature, an internally heated nest of tubes is fitted in the casing. The tubes are provided with gills of interstitial formation penetrating into all parts of the effective space within the casing.

C. E. Tarte. U.S.P. 1,992,133, 19.2.35. Apparatus for the continuous treatment of oil with reagent. It consists of a sloping cylindrical vessel divided by means of a partition into a mixing and a settling compartment. The settled reagent flows by gravity back into the mixing chamber. The entering stream of raw oil by jet action draws reagent from a collecting space into a pipe outside the settler, mixes the oil and reagent in the pipe and receives in the latter a further dosage of fresh reagent. The mixture then enters the settling drum for separation and the refined oil is continuously removed. W. H. T.

574. Patents on Cracking. Gasoline Products Co. E.P. 424,050, 13.2.35. Cracked residue is partly vaporised by being introduced into a flashing zone at reduced pressure. Fresh heavy charging stock is also passed into the zone, and is also partly vaporised by the heat of the cracked residue. The mixed vapours are removed and cracked and the products introduced into the flashing zone below the point of withdrawal of unvaporised oil.

E. C. Houdry. U.S.P. 1,989,692, 5.2.35. Apparatus for catalytic cracking comprising at least two converters for continuous operation, the contact mass in one converter being on stream, whilst that in the other converter is undergoing regeneration.

M. W. Barnes. U.S.P. 1,989,731, 5.2.35. A heavy and a light reflux is separated from cracked distillate; the former is introduced direct into the reaction zone, the latter being cracked separately and discharged into the same reaction zone.

R. E. Burk. U.S.P. 1,989,737, 5.2.35. A hydrocarbon too heavy for motor fuel and a petroleum naphtha are mixed and heated to 700–1125° F., the conversion being completed by admixture with oxygen in a reaction zone.

E. J. Houdry. U.S.P. 1,989,927, 5.2.35. Means for effecting heat transfer in catalytic cracking. A convection medium is used to convey heat from the exterior of a converter in exothermic reaction to that of one in endothermic reaction.

R. C. Lassiat. U.S.P. 1,989,934, 5.2.35. Heat exchange in catalytic cracking processes using a constant-temperature heated medium.

J. D. Seguy. U.S.P. 1,990,254, 5.2.35. Conversion of relatively heavy oils with simultaneous reconversion of intermediate products from the primary conversion.

J. C. Morrell. U.S.P. 1,990,303, 5.2.35. Liquid-phase cracking in which a heavy reflux is re-cycled and a light reflux is mixed with distillates from cracked residue and the mixture cracked separately.

W. O. Keeling. U.S.P. 1,990,697, 12.2.35. Vapour-phase process, the heating being effected by means of combustion gases free from oxygen.

J. B. Heid. U.S.P. 1,990,868, 12.2.35. A cracking process in which, prior to cracking, the charging stock is topped by heat exchange methods.

E. F. Nelson. U.S.P. 1,990,877–8, 12.2.35. A method of applying heat in the " tube and tank " process by means of circulation of heating gases.

J. G. Alther. U.S.P. 1,991,440, 19.2.35. Reflux condensate from the distillation of cracked oil is subjected to drastic cracking and then introduced into a pressure distillation zone.

W. O. Keeling. U.S.P. 1,991,750, 19.2.35. Cracking oil by means of hot combustion gases substantially free from oxygen and carbon monoxide.

R. E. Wilson. U.S.P. 1,991,971, 19.2.35. A combined coking and cracking process.

G. Egloff. U.S.P. 1,992,299, 26.2.35. Crude oil is topped, the gasoline is cracked in the vapour phase and the residue subjected to liquid-phase conversion. The cracked products are blended and distilled.

E. Houdry. U.S.P. 1,992,307, 26.2.35. Means for controlling the temperature of a catalytic mass during regeneration in the conversion of hydrocarbons.

J. Carlstrom. U.S.P. 1,992,470, 26.2.35. A lining for steel vessels used in cracking processes.

A. D. Smith. U.S.P. 1,992,512, 26.2.35. Light hydrocarbons are cracked in the vapour phase and the products mixed with heavy oil at an incipient cracking temperature. The mixture is maintained under cracking conditions until the desired degree of conversion has taken place.

E. C. Herthel. U.S.P. 1,992,614, 26.2.35. Cracking apparatus, employing a double vaporisation zone and a system of heat exchange.

E. W. Isom. U.S.P. 1,992,616, 26.2.35. Oil is strongly heated (900° F.) and then suddenly cooled by discharge into a bath of fused caustic alkali. W. H. T.

Universal Oil Products Co. Dutch P. 62,840, 18.10.32. Cracking of oil in a heated coil under high pressure. The cracking products are mixed with a heated light oil in a low-pressure evaporator.

Universal Oil Products Co. Dutch P. 63,349, 28.11.32. Oil is cracked in a heated coil under high pressure by passing it through two reaction zones. The cracking products form coke and gases in a low-pressure evaporator. P. C. K.

575. Patents on Hydrogenation. Int. Hydn. Pat. Co. E.P. 424,531, 22.2.35. Motor spirit, middle oil or lubricating oil is subjected to mild treatment with a hydrogenating gas at 100–275° C., so that olefines, resin, or asphalt, which tend to give rise to the formation of deposits, are hydrogenated. The pretreated product is then subjected to more drastic treatment.

M. Pier. U.S.P. 1,989,822, 5.2.35. Carbonaceous materials are hydrogenated, liquid and gaseous products are separated, and the latter subjected to fractional condensation in several stages of increasing pressure. The normally gaseous hydrocarbons finally obtained are returned to the hydrogenation process.

M. Pier. U.S.P. 12,990,708, 12.2.35. Destructive hydrogenation of carbonaceous material, using a gas obtained by the degasification of a solid bituminous material. Prior to use, the impure gas is freed from unsaturated hydrocarbons, sulphur compounds, oxides of carbon, etc., by catalytic hydrogenation at 350–700° C., and at atmospheric pressure. W. H. T.

G. F. Forwood. Dutch P. 61,242, 17.5.32. Destructive hydrogenation of high molecular hydrocarbons by heating the vapour with steam in the presence of an alloy containing Fe, Sn, Ni, and Mo.

I.G. Farbenind. A.-G. Dutch P. 63,236, 18.11.32. Catalytic hydrogenation of distillable carbonaceous material in the presence of catalysts formed by halogens and/or combined with one of the following: Bo, C, Si, P, As, Sb, S, Se, and Te or compounds derived therefrom and besides a metal oxide, hydroxide, sulphide or phosphate of a metal of the 5th or 6th group or compounds thereof not mentioned above. Organic iodine compounds with Mo or its compounds are excepted.

I.G. Farbenind. A.-G. Dutch P. 63,377, 30.11.32. Catalytic pressure hydrogenation of solid or liquid carbonaceous material in the presence of a catalyst, viz. a halogeneous compound (iodine) of Mo, Wo, and V, together with other metals of the 1st to 8th groups (especially the 5th and 6th groups). P. C. K.

576. Patents on Crude Oil. W. B. Lerch. U.S.P. 1,990,293, 5.2.35. Batch treatment for the dehydration of emulsified oil, designed to eliminate the disadvantages of continuous treatment. The emulsion is agitated preferably at 190–200° F. with air in the presence of salt water and/or a chemical treating agent. W. H. T.

577. Patents on Gas. A. Schmalenbach. E.P. 423,328, 30.1.35. Removal of benzene and naphthalene from coal distillation gases by washing with absorption oil. The latter is then steam distilled and the distillate subjected to two rectifications. Naphthalene is removed in solid form from the residue of the final rectification by cooling, the liquid component being returned to the absorption stage together with the residues from the distillation and preliminary rectification.

Chem. Eng. Corpn. E.P. 423,762, 7.2.35. Regeneration of spent ammoniacal cuprous solutions from the purification of hydrogen produced by the water gas process and containing dissolved carbon monoxide, carbon dioxide, and ammonia. The solution is heated to expel dissolved gases, which are then scrubbed with cold water. Carbon monoxide and part of the carbon dioxide are allowed to escape, the water is heated to expel the ammonia, and returned to the ammoniacal cuprous solution. W. H. T.

W. B. Plummer. U.S.P. 1,991,353, 12.2.1935. Polymerisation in tubular reactors of gaseous olefines at pressures 1000–3000 lb./sq. in. and temperatures 800–1000° F. using a stream of oil in an adjacent bank of tubes to absorb the exothermic heat of polymerisation, thereby stabilising the polymerisation temperature and effecting cracking of the oil stream.

W. B. Plummer. U.S.P. 1,991,354, 12.2.1935. Polymerisation of gaseous olefines to motor spirit in stages, with partial cooling and removal of condensable products between each stage.

R. E. Burk. U.S.P. 1,991,593, 19.2.1935. Process for the conversion of gaseous hydrocarbons to motor fuel using as heating agents, vapours of metals such as zinc or cadmium, or cadmium–mercury alloys under pressure. E. N. H.

578. Patents on Motor Spirit. E. W. J. Mardles and W. Helmore. E.P. 423,938, 11.2.35. Motor spirits and lubricating oils are rendered resistant to oxidation by the addition of one or more weakly basic nitrogen compounds, *e.g.* acyl derivatives of mono-alkyl or mono-aryl hydrazines, of aliphatic diamines, of aliphatic amines or of secondary amines.

J. Herzenberg. E.P. 424,564, 18.2.35. Desulphurisation by means of peracids which contain the group –O–OH, and by hydrolysis will form hydrogen peroxide. Examples of the refining agent are per-acetic, per-propionic, and mono-per-sulphuric acid.

Du Pont de Nemours. E.P. 424,582, 25.2.35. Gum formation in motor fuels is inhibited by the addition of a small proportion (0·005–1% by wt.) of *p*-hydroxyphenylaminoacetonitrile or of its αα-dimethyl-, α-*n*-propyl-, α-*n*-hexyl-, or α-(α′-ethyl-β′-*n*-propyl-vinyl)-derivative.

J. Herzenberg. E.P. 424,616, 18.2.35. Desulphurisation by treatment with hydrogen peroxide or alkali peroxides.

S. E. Campbell. U.S.P. 1,991,049, 12.2.35. Cracked distillate is decolorised by upward passage through a succession of pools of sulphuric acid of sufficient strength to remove basic impurities without affecting the unsaturated hydrocarbons. The

oil is next passed through a contact mass, then through an alkaline solution, and is subsequently passed through a succession of pools of concentrated sulphuric acid at a low temperature. The treated material is finally neutralised.

E. W. Hultman. U.S.P. 1,992,308, 26.2.35. Sulphuric acid (35–80% strength) is electrolysed to form oxidised compounds and then used immediately for the treatment of oil. W. H. T.

Standard Oil Dev. Co. Dutch P. 62,270, 20.8.32. An inhibitor for ageing gasoline, one of the two components of which consists of a dye-stuff with anti-ageing properties, acting as an indicator.

I.G. Farbenind. A.-G. Dutch P. 63,310, 24.11.32. The addition of 0·01 to 0·05% of wood tar to motor fuels, containing unsaturateds, as an inhibitor against ageing and to prevent decrease of anti-knock value. P. C. K.

579. Patents on Lubricating Oil. Alco Products Inc. E.P. 423,303, 23.1.35. A solvent-dewaxing process, the solvent being a liquefied normally gaseous hydrocarbon. The solution of oil-wax and solvent is cooled, and at the same time a portion of the solvent is removed from the solution as soon as it is freed from the wax at such a rate that the percentage of solvent in the oil-solvent component is maintained substantially constant at that existing at the critical cooling temperature.

A. A. Griffith and W. Helmore. E.P. 423,441, 1.2.35. A lubricating oil containing a small proportion (1%) of an organic compound of chromium (oleate). The use of this addition is stated to inhibit the formation of gum and other deposits and to minimise corrosion of metal surfaces with which the oil comes into contact.

J. W. Orelup. E.P. 424,205, 18.2.35. A colouring material for lubricating oil is prepared by heating together a water insoluble soap, stearic acid, and a dye of the acridine, rhodamine, eosine, or eurhodine type until fluorescence has been developed.

M. B. Miller & Co. E.P. 424,000, 13.2.35. Solvent extraction of lubricating oil by countercurrent extraction with a mixture of a liquefied normally gaseous hydrocarbon and a naphthenic solvent.

Bat. Petr. Mij. E.P. 424,380, 20.2.35. An extreme pressure lubricant containing phosphoric or arsenic compounds preferably having an organic radical with a long chain in the form of an ester, other than those in which the phosphorus or arsenic atom is joined to an aryl radical by means of a sulphur or oxygen atom.

J. J. Johnson. E.P. 424,569, 11.2.35. Lubricating oils are prepared by subjecting a crude high molecular paraffin wax condensation product to extraction with hydrocarbons (critical temperature below 250° C.) at above 25° C. and below their critical temperature. The hydrocarbons are liquefied normally gaseous materials.

Elek. Ges. E.P. 424,578, 25.2.35. Lubricants are prepared by adding to a cutting oil at normal temperatures, a paste containing colloidal sulphur. The paste is prepared by grinding sulphur in an oily, fatty, or aqueous carrier.

E. Kramer. E.P. 424,607, 25.2.35. A graphite lubricant is produced for use in admixture with oil or grease, by mixing colloidal graphite with train oil. W. H. T.

C. H. Ambler, Jr. U.S.P. 1,990,359, 19.1.33. Separation of solid impurities from lubricating oils by dispersing 0·1–1% of a commercial pentanol-amine mixture in the oil at a temperature of 150–200° F. and separating the impurities by centrifuging at this temperature.

W. L. Nelson and G. H. Fancher. U.S.P. 1,990,664, 12.2.35. Production of lubricating oil by subjecting heavy material which is non-volatile at 680° F. and at atmospheric pressure to a temperature of 700° F. and 12 mm. pressure absolute for a period sufficient to cause thermal decomposition.

L. M. Henderson, S. W. Ferris, and H. C. Cowles, Jr. U.S.P. 1,991,389, 19.2.35. An improvement in wax-sweating is described. A small amount of wax containing chiefly needle form crystals, is added to the wax and the mixture is sweated. The sweated composite wax is fractionally distilled to effect separation of needle wax which is used again.

G. B. Coubrough. U.S.P. 1,991,791–2, 19.2.35. The distillation of heavy lubricating oils is described. A reduced crude oil is fractionated in a primary column to obtain a residue consisting of heavy lubricating oils and asphalt, and this residue is mixed with a light diluent, *e.g.* kerosine or gas oil. The diluent and lubricating are flash-vaporised from the asphalt in a vacuum column. W. S. E. C.

J. Stone & Co. Dutch P. 60,474, 9.3.32. Finely-divided solids are separated from lubricating oils, etc., by dispersing water into it and centrifuging. The suspended solid is coagulated.

Bataafsche Petr. Mij. Dutch P. 63,817, 5.1.33. Hydrocarbon mixtures are refined with sulphuric acid in such a way that the products are oil-soluble sulphonic acids only. To prevent the evolution of sulphur dioxide, definite concentrations, temperature, and time of reaction are necessary.

I.G. Farbenind. A.-G. Dutch P. 64,852, 3.4.33. The pour point of oils, etc., is lowered by the addition of condensation products derived from aliphatic high molecular carboxylic acid chloride and occasionally with cyclic hydrocarbons, alkenes or mixtures thereof.

Bataafsche Petr. Mij. Dutch P. 66,021, 15.7.33. Synthetic lubricating oils are prepared by polymerisation of unsaturated cracking products obtained by cracking a heavy oil in two stages, the first being in the liquid phase. The reaction product has a boiling range of 150–450° C., and after a physical or chemical treatment is cracked in the vapour phase.

Lummus Co. Dutch P. 66,655, 12.9.33. Lubricating oils are separated from a mixture of oil and non-volatile residue by a flash evaporation and condensation. The mixture is diluted with a volatile diluent of a boiling point lower than the oil.

P. C. K.

580. Patents on Asphalt. R. Herrmann Ltd. E.P. 424,415, 18.2.35. An asphaltic composition is prepared by the incorporation of Florida bleaching earth in a bitumen of penetration not lower than 40. Epuré and a fine mineral filler may also be added to the mixture.

M. Ernotte. E.P. 424,494, 14.2.35. An asphaltic product is prepared by mixing at least 20% of a finely divided bitumen (melting point 40–65° C.) with sugar scum.

H. L. Allan. U.S.P. 1,990,466, 12.2.35. A process of producing asphaltic products from an aromatic extract of a mineral oil. The extract is obtained by refining crude oil with a selective solvent (SO_2, aniline, or phenol). The extract is oxidised after recovery of the solvent under conditions which inhibit distillation—*e.g* air-blowing under pressure—200° C. and 50 lb. per sq. in.

W. H. T.

581. Patents on Special Products. I.C.I. E.P. 423,877, 11.2.35. Production of ethyl alcohol by catalytic hydration of ethylene. The catalyst comprises cadmium metaphosphate, together with a small quantity of one or more of the metaphosphates of barium, strontium, titanium, chromium, and tellurium.

Stand. Oil. Dev. Co. E.P. 423,768, 7.2.35. A cleansing material comprising an acid sludge sulphonate and a detergent which comprises an alkali metal or salt of an alkyl hydrogen sulphate containing at least 10 carbon atoms in the molecule.

W. W. Triggs. E.P. 424,191, 18.2.35. Purification of phenols for the purpose of eliminating catalyser poisons by means of liquid-phase treatment with sulphuric acid. The concentration of acid and temperature of treatment are such as to avoid appreciable chemical action between phenol and acid (not exceeding 35° C.—with 10–30% of 50–100% acid).

Du Pont de Nemours. E.P. 424,572, 21.2.35. Fungicides and insecticides are prepared by the emulsification of an oil (80–100° Say.) with water, together with an emulsifying agent and a mercuri-derivative of an aliphatic hydrocarbon.

W. H. T.

Distillers Co. Dutch P. 63,943, 16.1.33. Synthesis of ethyl alcohol by catalytic addition of ethane and water vapour at a high temperature and normal or elevated pressure. The catalyst contains the uran-structure and phosphoric acid not exceeding 95% by weight.

W. Möhring. Dutch P. 66,749, 21.9.33. Coking of crude oil, etc., by continuous distillation, the charging stock passing through the reaction zone in separate drums.

I.G. Farbenind. A.-G. Dutch P. 68,028, 5.1.34. Polymerisation of methylpropene in the presence of a volatile halogeneous compound at a temperature below — 10° C.

P. C. K.

582. Patents on Coal. H. Dreyfus. E.P. 423,860, 28.1.35. Hydrocarbons are produced from coal by heating (400–1000° C.) the latter under the pressure (50–200 atm.) generated by the evolved gases. The coal is mixed with an anti-caking material and a catalyst suitable for use in the hydrogenation of coal.

W. H. T.

Class 700. Utilisation.

583. Atmospheric Pressure Oil Burners. W. Rödl. *Petr. Zeit.*, 6.3.35, **31**, 9–15.—The underlying principles of various types of burners are given, those dealt with being:—1. Wick burners in which the air for combustion surrounds the wick. 2. Vapour burners in which the oil is evaporated from a thin film by upward passage of air. 3. Vapour burners in which the oil is evaporated from a hot surface and the vapours are mixed immediately with air. 4. Vapour burners in which the oil is vaporised from a multiple of containers and mixed with air after evaporation. 5. Vapour burners in which the heat of evaporation is obtained by conduction through the metal of the burner. 6. Tube vapour burners in which evaporation is effected from a metal coil and subsequently mixed with air. Sectional diagrams of the above burners are given. W. S. E. C.

584. Performance of Engines at Low Operating Temperatures. A. J. Blackwood. *J.S.A.E.*, 1935, **36**, 70–76.—Low-temperature operation is dealt with by the Author under four principal headings, viz. Starting, Oil Pumping, Sludging, and Wear. It has been found that a speed of 40 r.p.m. is necessary to start, and previous work indicated that if the oil had a viscosity below 30,000 sec. Saybolt Universal, hand cranking was possible. It is now shown, however, that the torque necessary for cranking varies also with temperature, and experimental figures are given showing that the torque necessary to crank at 40 r.p.m. with oil of 30,000 sec. viscosity varies between 61 ft.-lb. at 25° F. and 80 ft.-lb. at − 15° F., probably due to different expansion coefficients and distortion of metals with temperature change. It is also found that if a battery starter output is normal at 80° F., it falls to 61% at − 15° C. In the light of present knowledge obtained from car tests, curves have been prepared showing maximum permissible viscosity for hand and battery starting at 40 r.p.m. (18,000 secs. and 23,000 secs., respectively, at 0° C.).

As regards oil pumping, it has been shown by various investigators that oils will pump freely down to their pour point, and in some cases to 10° below. It has not been recognised, however, that some oil systems with pumps above the oil level will not handle oil with a viscosity above 35,000 secs., owing to the fact that the flow is very sluggish, and when the oil has been removed from around the pump inlet, air is sucked in, causing locking. A series of experiments with an engine in bad mechanical condition was carried out to obtain sludging, and it was found that most of the latter was caused by water from the combustion products getting into the crankcase. The effects were controlled by fitting the cylinder head with an auxiliary external water-jacket to vary the temperature of the valve rocker chamber. At ordinary mixture strength it is found that the water in combustion products will condense if brought into contact with surfaces below 120–145° F., varying with the mixture strength or the weight per cent. of water present. It has been found that 13·2 times the normal wear occurs during the starting and warming-up period, and represents the equivalent of 130 miles at normal temperature. The Author advises the use of an oil of such viscosity at starting temperature that an easy start is assured. To minimise wear during starting, use an oil of the highest possible viscosity index and warm up as quickly as possible. C. H. S.

585. Method of Studying Combustion Process in Engines. M. Brutzkus. *Ann. des Comb. Liq.*, 1935, **10**, 141–142.—The Author considers the General Motors Co. method of withdrawing samples of the combustion mixture from the cylinder to be unsatisfactory, in that the sample withdrawn may not be representative, and that conditions such as air-fuel ratio may alter. He suggests as a better method running in series at a constant speed with an electric motor and the provision of cam gear to open the exhaust valve at any desired moment. It is considered that the sudden opening of the exhaust valve, causing the resultant sudden pressure fall, will chill the reaction mixture and stop further reaction. The contents of the cylinder can thus be drawn off through a freezing mixture and accumulated to any desired amount; changing the cam timing allows the engine cycle to be explored. W. E. J. B.

586. Fuel Injection as Applied to Aircraft Engines. J. F. Campbell. *J.S.A.E.*, 1935, **36**, 77–88.—The unsatisfactory behaviour of carburettors when manœuvring led the U.S. Air Corps to investigate the possibility of mechanical metering of fuel as far

back as 1925. The present paper deals with the development over a period of years of a complete fuel injection system for several types of engines. Details of the most satisfactory type developed up to the present are given, and the article includes a great many graphs and diagrams detailing the performance of the apparatus and engines fitted with it.

It is shown that a considerable gain in performance is possible by replacement of the carburettor by the fuel injection method of metering, brought about almost entirely by the elimination of the pressure fall through the air heater, carburettor, and hotspot. The Author believes that fuel injection offers the greatest possibilities as regards the improvement of the Otto cycle engine. C. H. S.

587. New Fuel Injection Pump. Anon. *Aut. Eng.*, 1935, **25**, 81–83.—A description of a pump in which a swash plate is utilised for the operation of the pump plungers. The tappets are arranged in a circle with axes parallel to each other and the driving-shaft, and reciprocate in a tappet block each operating a pump plunger. The governor gear, the eccentric for the fuel transfer pump, and the timing control mechanism are driven by bevel gearing from the main shaft of the pump. In the centre of the hydraulic unit is a rotary valve driven by an off-set tang. From each plunger, by-pass holes connect with a fuel supply duct surrounding the central rotary valve and broken only by a land on the valve. The land is triangular in shape, so that by controlling the axial position of the rotary valve the amount of fuel delivered to each line can be controlled. By using different rotor designs it is possible to obtain (*a*) fixed start of injection with ending variable by throttle control, (*b*) fixed end of injection with start variable by throttle control, (*c*) both start and end variable by throttle control, (*d*) rate of injection variable by throttle control with fixed start and end or in combination with *a*, *b*, or *c*. The delivery capacity of the pump is determined by the swash-plate angle. The swash plates are interchangeable, so that one unit may serve for a range of engine sizes varying from 26 to 260 cu. in. piston displacement. The article is illustrated with external views and sections of the pump and accessories such as special filter and fuel transfer pumps. C. H. S.

588. Iron Carbonyl as an Anti-Knock Compound. M. J. Leahy. *Refiner*, 1935, **14**, 82–84.—Quoting the experience of some refiners that fresh gasoline sometimes runs as high as 96 octane, reverting on standing to 61, the Author directs attention to the fact that if iron carbonyl could be made insensitive to light, it would be an ideal anti-detonant, as less than 0·1% by volume raises the octane number by at least 35 integers, whilst the material is practically odourless and apparently without ill effect on machinery or personnel. Although a large number of patents have been granted on various compounds which, it is claimed in each case, make iron carbonyl insensitive to light, apparently none is now in commercial use. Those experimenting along similar lines are recommended to search the literature and patents, an extensive bibliography to which is appended to the present article. B. C. A.

589. Synthetic Motor Fuel of 100 Octane Number to be Available for Aviation. C. O. Wilson. *Oil & Gas J.*, 7.2.35, **33** (38), 40.—At the third annual meeting of the Institute of the Aeronautical Sciences papers were presented on the progress made in aviation. Dr. Edgar outlined recent developments in the synthetic production and blending of fuels of high anti-knock properties, and expressed the opinion that fuels of 100 octane number and above will come into wide use and prove an economy in commercial air transport operation. Of the three grades at present available, *i.e.* 70, 80, and 87 octane rating, the demand for the latter is increasing for heavy duty transport. This fuel represents approx. the limit obtainable by the use of straight run or cracked gasolines from natural crude with the addition of T.E.L. Three classes of hydrocarbons known to possess extremely high anti-knock value are: (1) branched chain paraffins, (2) branched chain olefins, (3) certain aromatics. Hydrocarbons of the first group possess advantages in respect of retention of anti-knock value under varying conditions of test, chemical stability, and higher heat of combustion per lb. Substantial quantities of *iso*-octane have been produced from the *iso*butylene in refinery gases in the last two years. In view of the higher cost of such synthetic fuels, it is probable that they will be blended with suitable gasolines and an anti-knock agent to the desired standard.

F. D. Klein, Air Corps, reported results of flight tests on 100 octane rating fuels

as compared with 92 by Air Corps method, showing an increase of 15–30% possible in power output of engines and increase in speed at which airplanes could be safely operated. Flight tests with pursuit planes showed that full throttle operation was made possible by the use of 100 octane fuel and reduction of 30° C. in cylinder head temperature during climbing tests in which overheating checked the rate of climb when using 92 octane fuel. The Air Corps have prepared a specification (No. X 3575) for 100 octane fuel allowing a max. T.E.L. content of 3 ml. per gal., 1000 gals. of *iso*-octane was obtained, and four fuels of 100 octane rating by Air Corps method were prepared: (1) 50% *iso*-octane, 50% aviation gasoline + 3 ml. T.E.L. gal. (2) 50% *iso*-octane, 50% aviation gasoline + 6 ml. T.E.L. per gal. (3) Standard ref. fuel C – 6 + 8·5 ml. T.E.L. per gal. (4) 37·5% *iso*-octane, 37·5% high aromatic content gasoline, 25% *iso*pentane + 1 ml. T.E.L. per gal. The four fuels were tested in Wasp and Cyclone engines. The principal results were: (1) Decrease of 1 octane no. in anti-knock value per 11–18° F. increase in mixture temperature, so that highly supercharged engines would probably require inter-coolers for max. performance at low altitudes regardless of fuel used. (2) Multi-cylinder engines show close agreement with C.F.R. rating by Air Corps method except in the case of fuel 4, which, in the Cyclone, was rated about 2 numbers lower. (3) Fuel 2 is rated the same as fuel 1 in all engines. (4) Addition of 3 ml. T.E.L. per gal. to pure *iso*-octane results in an increase of only 3 octane numbers by Air Corps method of test. R. A. E.

590. Use of Liquefied Gases as Motor Fuel. J. C. Albright. *Nat. Petr. News*, 27.2.35, **27** (9), 48.—With the development of suitable tanks and regulating equipment and the provision of refueling facilities, the use of liquid butane and propane is increasing in California. The liquid fuel is reduced in pressure through two regulators to approximately atmospheric pressure, suitable precautions being taken to prevent refrigeration. Carburetion is effected in the original carburettors or in specially designed mixing chambers. The new fuel has been used chiefly on heavy duty commercial units, and very gratifying results are claimed. The fuel is usually a mixture of 80% butane, 20% propane, and has an octane number of 100. H. G.

591. Nature and Manufacture of Cold Asphalts. Kadmer. *Oel u. Kohle*, 1935, **11**, 225.—A general account of bitumen emulsions with special reference to road building. A large number of patents relating to manufacture, classified according to the emulsifying agent employed, are summarised. P. G. H.

592. Substitute for Asbestos as a Filler for Bituminous Jointing Material. P. Herrmann. *Asphalt u. Teer*, 1935, **35**, 206–207.—Slag wool is suggested as an alternative to asbestos in the preparation of bituminous jointing material. C. C.

593. Petroleum Derivatives in Paint and Varnish Industry. C. G. Gray. *Oil and Col. Trades J.*, 1935, **87**, 703–708.—The Author suggests three classifications for petroleum products useful to the paint and varnish industry. Firstly, products present in the crude which are isolated in the course of normal refining. Secondly, products, not present as such in the crude, which may be isolated during refining. Thirdly, products manufactured from certain members of the second class. In class one, asphalts are considered from the standpoint of their use in paints; a high softening point and low penetration are desirable. White spirit may be the solvent medium. Asbestos–bitumen compositions are mentioned, whilst the light bitumens (albino) are described, as are the methods used for incorporating such bitumens in paint. Other derivatives in class one considered are special boiling-point spirits and their use in the extraction of seed oils and as lacquer diluents; also naphthenic acids, their structure, extraction, and applications in the form of naphthenates. In class two, carbon black, hydrogenated spirits, and aromatics are considered, whilst class three comprises a variety of alcohols, glycols, esters, and ketones now being manufactured from cracked gases. W. E. J. B.

594. Permeability (to Water) of Bituminous Paints. H. Walther. *Asphalt u. Teer*, 1935, **35**, 297–298.—A comparison has been made of crude tar (3·5% water, 5·5% acids), distilled tar (2% acids), steam coal-tar pitch (1% acids, softening point 27°), and bitumen (softening point 28°). The method consists in coating a filter paper several times with the heated product, so that all samples show the same weight of impregnating material per sq. cm. The treated paper is then used to close a flask

containing calcium chloride. The flask is then placed in a metal box maintained at constant humidity (100%) for definite periods at 12–22° C. up to 24 days. The increased weight of the flask represents the amount of water passing through the treated paper. The crude tar is much inferior in this respect to the other samples.

C. C.

595. High-pressure Lubrication for Journal Bearings. G. Welter. *Engineering*, 1935, **139**, 274.—In this article are described experiments in which journal bearings are lubricated with oil at extremely high pressures.

In an endeavour to overcome the large frictional losses and resulting wear on starting up machinery with journal bearings, extra oil at pressures of 100–200 atmospheres is supplied to the top of the bearing. The bearing with its load is virtually lifted off the shaft. Curves are given, showing the variation of dynamometer readings with time using normal (pad-lubrication) and high pressure lubrication methods. For the latter method striking improvements are claimed, whether starting at a room temperature of 68° F. or at low temperatures of 37–41° F. Results also compare favourably with those obtained on grease-lubricated roller bearings.

J. L. T.

596. Colloidal Graphite in Oils. H. Higinbotham. *Aircraft Eng.*, April 1935, **7** (74), 95.—In order to prove that a surface in contact with an oil containing graphite takes on a graphoid surface, two shafts of practically pure iron were run in two bearings, one lubricated with plain oil and the other with colloidal graphited oil. After the test the shafts were very carefully cleaned, a thin layer from the surface of each was removed by careful turning, and the cuttings were washed with solvents to remove free oil and analysed. The shaft run with the graphited oil showed an increase in graphitic and also in non-graphitic carbon content, showing adsorption of oil as well as graphite. The shaft run with plain oil showed no increase in non-graphitic carbon.

A graphoid surface, by reducing the surface tension of the bearing surface, aids the flow and spread of oil, so that should the oil film be ruptured by sudden imposition of an excessive load, the film will be more readily re-formed and the period of metal-to-metal contact reduced. In addition, the graphoid surface and adsorbed oil film will act as lubricants pending re-formation of oil film. References are made to the investigations of Boutaric, Hardy, N.P.L., and Thomson, in order to show the lowering of the coefficient of friction due to incorporation of colloidal graphite in an oil, particularly during static and boundary lubrication conditions.

A recent report of the I.A.E. Research Committee shows that cylinder wear is largely due to corrosion. A graphoid surface resists the corrosive effects of the products of combustion, and by maintaining a complete oil film will further tend to reduce wear due to corrosion. A rusted bar was turned and polished to give a surface of uniform character, and run for a considerable period in two bearings lubricated, respectively, with plain oil and with the same oil containing graphite. The shaft was removed, cleaned with oil solvents, and subjected to action of corrosive oil dripped on to each bearing surface at constant rate. After 60 hrs. the portion run with plain oil showed marked corrosion, whereas the other showed only traces.

A number of tests were made to show the reduction in corrosion and wear of new piston rings when an upper cylinder lubricant containing colloidal graphite is added to the gasoline. A 4-cylinder engine was used, new rings and pistons were fitted to cylinders, 1 and 3, for the first test and to cylinders 2 and 4 for the test with upper cylinder lubricant added. The total loss in weight of rings was reduced from 0·401 gms. to 0·239 gms., and the reduction in loss more apparent in the cooler cylinders, when using the upper cylinder lubricant. A Shaw contorograph was also used to demonstrate differences in roughness of the side faces of rings due to corrosion when running with and without upper cylinder lubricant.

Shaw has also found that future running is improved if colloidal graphite is added to the coolant paraffin used during the honing and grinding of cylinders, since alternate expansion and contraction of the surface during finishing aids the graphite in penetrating the surface, and so retarding corrosion. Tests made showed that best results were obtained by burnishing in the presence of colloidal graphited oil, smearing the parts before assembly with the graphited "running-in" compound, and adding this compound to the sump oil for running in. Contour records made during running-in

periods with graphited and plain oils are shown. The advantages of incorporating graphite in upper cylinder lubricants are described. R. A. E.

597. Extreme Pressure Lubricants. E. H. Kadmer. *Oel u. Kohle*, 1935, **11**, 116–118.—This article is a comprehensive review of the Journal and Patent literature of the subject of extreme pressure lubricants. A summary of the theoretical principles involved is followed by detailed examination of the various substances and their effectiveness. References are quoted and figures for the reduction of coefficient of friction by certain agents are given. It is considered that the metallic soaps, *e.g.* zinc, aluminium, lead, are more effective than the alkali oil-soluble soaps in raising both viscosity and viscosity index, but they possess no surface activity. A French patent claims high-pressure lubricating qualities for the condensed chlorinated naphthalene pour point reducers. Sulphur is considered to act by the formation of a highly resistant film of sulphide, and this film is stronger when the sulphur is present in the free state. As a running-in compound, colloidal graphite has established itself as an active agent for dealing with the high pressures developed in new engines.
J. L. T.

598. Dilution of Crank-case Oils. H. N. Bassett. *Auto. Eng.*, 1935, **25**, 105–106.—Dilution is controlled by eight factors. The more volatile the fuel the greater the dilution, which can reach 30% of the crank-case oil. For petrol engines the figure generally reaches an equilibrium value, which in North America has been found to be 17% in winter and 10% in summer. This is not the case for Diesel engines, where dilution steadily increases and as much as 85% has been recorded. Controlled jacket temperature can reduce dilution by 20%, but the consequent reduction in the condensation of water vapour and subsequent corrosion is still more important. The higher temperature, however, means increased sludging of the oil. The temperature of the crank case governs the balance of condensation over evaporation of the diluent. Normal crank-case temperatures do not permit much evaporation from a 10% blend of diluent in oil; hence the importance of adequate ventilation. Rich mixture, short runs, and light loads all tend to increase dilution. The latter also varies with the type of engine, but the nature of the diluent is roughly the same for all types—boiling between 135° C. (275° F.) and 232° C. (450° F.) with 50% off at 176° C. (350° F.). Experiments with prediluted oils resulted in a compromise being reached with 10·5% of artificial diluent, which brought the viscosity down from 480″ to 200″ at 100° F. The composition of the diluent is independent of the fuel used, and contains 35–40% of unsaturated compounds. It is thought not unlikely that the latter are responsible for the formation of free carbon and polymerised products, rather than the oil itself. J. L. T.

599. Explosion and Fire Hazards of Hydrocarbon Tetrachloride Mixtures. G. W. Jones and R. E. Kennedy. *B. of Mines*, I.C. 6805, Nov. 1934.—An investigation has been made of the amount of CCl_4 that must be added to pentane, hexane, heptane, octane, and gasoline to render the mixtures non-inflammable under conditions of (*a*) complete vaporisation in an explosion tube, (*b*) exposure in an open dish, (*c*) ignition on a wick. It is pointed out that determination of the inflammability limits is complicated by the difference in boiling points and vapour pressures of the CCl_4 and hydrocarbons, and in the boiling points of the hydrocarbons present in a gasoline. Thus, in a mixture of a hydrocarbon and CCl_4 the liquid with the higher vapour pressure vaporises more rapidly, leaving a liquid of different composition and therefore different inflammability from the vapours.

Under conditions of complete vaporisation in an explosion tube the following percentages of CCl_4 were required to prevent flame propagation: C_5H_{12} — 66·7%; C_6H_{14} 70%; C_7H_{16} 70%; C_8H_{18} 66·7%; Naphtha (boiling range 97–155° C.) 70%; Gasoline (boiling range 31–205° C.) 58·0%. The low figure for gasoline is attributed to the low vapour pressure of the heavier ends, rendering complete vaporisation in the explosion tube impossible. The above figure represents ideal conditions when the vapours are of the same composition as the original mixtures.

Conditions under open storage were simulated by tests of mixtures in a watch glass ignited by a flame, it being noted whether the mixture continued to burn after the flame was withdrawn. C_5H_{12} burned with a steady flame even when the mixture contained 75% CCl_4 (vol.), due to the fact that the vapours from the liquid con-

tained a smaller proportion of CCl_4 vapour than the original mixture. C_6H_{14} burnt with a steady flame in mixtures containing up to 62·5% CCl_4. Above this figure the mixture would burn only when the flame was held just above the surface of the liquid. The addition of 75% CCl_4 rendered the mixture non-inflammable. With C_7H_{16} 50% of CCl_4 prevented steady burning and 62·5% rendered it non-inflammable. C_8H_{18} and the naphtha were non-inflammable when mixed with 50% CCl_4 and gasoline gave a momentary flame with mixture up to 63·5% CCl_4, 66·7% being necessary to impart non-inflammability.

To investigate hazards which might arise when hydrocarbons are spilled on floors or on waste materials (such conditions being more dangerous than ignition in an open container where hydrocarbons of lower vapour pressure do not ignite), a ¼-in. round asbestos wick was dipped in the liquid mixtures and ignited. In general, a higher percentage of CCl_4 was required to prevent burning than when the mixtures were exposed in an open dish.

With the different hydrocarbons the following results were obtained :—

C_5H_{12}—up to 66·7% CCl_4 gave steady flame, 25·0% CCl_4 burnt for 2 seconds.

C_6H_{24}—up to 63·5% CCl_4 gave steady flame, 75·0% CCl_4 momentary flame.

With C_7H_{16}, C_8H_{18}, naphtha, and gasoline, mixtures containing up to the following percentages of CCl_4 burnt with a steady flame :—50%, 63·5%, 50·0%, 50·0%.

To give complete non-inflammability, 63·5%, 70·0%, 62·5%, and 58·0% CCl_4 were required

In general, therefore, gasoline and naphtha should contain 70% of CCl_4 by volume to eliminate fire and explosion hazards, whilst C_5H_{12} must contain 80% CCl_4 to prevent burning in an open vessel. Mixtures with CCl_4 of products containing hydrocarbons with lower vapour pressures than CCl_4 will give on partial evaporation a residue weaker in CCl_4 than the original mixture, so that addition of CCl_4 from time to time is necessary to prevent flammability. C. L. G.

BOOKS RECEIVED.

American Petroleum Institute: Proceedings of the Fifteenth Annual Meeting, Nov. 1934. Sections I–IV. 1935, A.P.I., New York. 50 cents each section.

The first section of the Proceedings contains the Reports of the various Divisions of the A.P.I., together with several papers of general interest.

In Section II the papers presented at the Marketing Session are given, and this section contains also articles on Diesel oil and Diesel engines.

The principal subjects dealt with in Section III, Refining, are lubrication and general refining problems, and the Diesel papers in Section II are also repeated in this section.

In the Production Section, No. IV, abstracts only are included of the papers presented, as it is intended to publish an annual volume on Production to contain these papers, together with those presented at other meetings of the Institute.

Iron and Steel Institute: Third Report of Corrosion Committee. 214 pp. 8vo. 1935, Iron and Steel Inst., London.

This report was presented for discussion at the Annual Meeting of the Institute on May 1st, 1935. It deals with field tests on atmospheric corrosion and marine corrosion and also contains papers on laboratory research on corrosion problems.

Report of Newnes Investigation Committee on the Newnes–Capertree Shale Oil Project. 216 pp. F'scap. 1934, Govt. Printer, Sydney, N.S.W. 10*s*.

The Newnes Investigation Committee was appointed in 1933 by the Governments of the Commonwealth of Australia and New South Wales to inquire into the possibility of developing the shale oil industry in the Newnes–Capertree area on a sound basis. The report details the activities and inquiries of the Committee and presents the conclusions reached.

Storing of Bitumen. 63 pp. 1935, Shell Co.

In this booklet the story of bitumen up to about A.D. 1800 has been outlined and a number of illustrations show the uses made of this material in antiquity.

U.S. Bureau of Mines.

Tech. Paper 561. Mechanical Equipment Used in the Drilling and Production of Oil and Gas Wells in the Oklahoma City Field. G. Wade. 89 pp. 8vo. 1934, Govt. Printing Office, Washington, D.C. 10 cents.

The average depth of the oil-bearing formation in the Oklahoma City field is 6500 feet, the initial formation pressure being about 2600 lb./sq. in. The paper gives the results of a study devoted chiefly to new equipment developed to meet the requirements in this area.

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Class 100. Geographic Occurrence.

600. Conditions within the U.S. Petroleum Industry. J. E. Jones. *Petr. World*, 1935, **32** (414), 75–78.—A short article discussing the effect of the U.S. Supreme Court decision that Section 9-C of the N.R.A. was within the bounds of the Federal Constitution, and giving tables covering the month of November from 1924 to 1934 showing the flow and balance, the supply and demand, the stocks, days' supply and price, of all oils during that period. G. R. N.

601. Review of the South American Oil Situation. Anon. *Petr. World*, 1935, **32** (414), 55–57.—An abstract of an article in *Independent Monthly* by M. A. Spellacy on the possibilities, proven and otherwise, of oil production in the eastern side of South America, with some account of the developed oil properties. G. R. N.

602. Developments of the Rumanian Petroleum Industry during the Last Five Years. I. Abuav. *Petr. Z.*, 24.4.35, **31** (17), 1–12.—The petroleum industry in Rumania during the last five years is dealt with, and statistical figures are given for the production of crude oil in the most important and active oilfields. These are compared with one another during each of the five years, and the various taxes levied on the petroleum products due to the fiscal year are enumerated. W. S. E. C.

603. Petroleum in the Irish Free State. S. E. Coomber. *Mon. Petr. Roum.*, 1935, **36**, 469–472.—Statistics are available from 1924, and the first table of figures in the paper covers the development of motor vehicles from that date to 1931, and a continuous increase is recorded. The country has no sources of combustibles, with the exception of peat deposits, which are utilized merely for domestic purposes by the neighbouring dwellers. Hydro-electric development on the Shannon has thus been started.

Petroleum imports are listed for the period 1924–1932 inclusive. In the latter year about two and a quarter times as many tonnes of petroleum were imported as were in the year 1924. Figures for 1932 were 253,268 tonnes, including 128,435 tonnes of gasoline, 66,148 tonnes of kerosine, 10,797 tonnes of lubricating oil and 19,735 tonnes of asphalt. The main suppliers were U.S.A. 32·1% (gasoline and kerosine), England 41·7% (gasoline, kerosine, asphalt and gas oil), and Russia 9·1% (gasoline, kerosine and gas oil). The greatest part of the English exports are, of course, re-exports.

The Customs duties on hydrocarbon oils are as follows: 8*d.* a gallon on light oils, which are defined as showing at least 50% evaporated at a temperature not exceeding 185° C. and 95% at a temperature not exceeding 240° C., or which flash below 22·8° C. Heavy oils are defined as follows:—Sp. Gr. 0·835–0·950; P.M. flash, 285–410° F.; Red I at 70° F., 100–1000 secs., and pay 50% ad. valorem duty. Preference for products marketed by members of the British Confederation of Nations is granted in some cases. Lubricating oils, not in the heavy hydrocarbon class, pay one shilling an Imperial gallon tax. W. E. J. B.

Class 200. Geology and Origin.

604. Oilfields of the Gulf Coast Area Found in Sediments of Late Geological Age. E. G. Woodruff. *Oil & Gas J.*, 4.4.35, **33** (46), 38, 149.—This paper reviews the history of salt dome production in the Gulf Coast area and summarizes the evidence of their formation. The main salt mass is probably of Permian or Cretaceous age and, from the evidence of drilling records, is certainly more than 10,000 ft. deep. The domes vary in size from a few hundred feet to 2 or 3 miles in diameter, and are found only in basinal areas. This leads to the conclusion that the main salt mass was deposited only in basins, and that there are many more domes awaiting discovery under the Gulf itself.

The domes are not all productive, for out of a total of more than 200 only 90 have yielded any oil. The accumulation of oil over the crests and around the edges of the domes is briefly discussed, attention being directed to the fact that overhang may give the false impression that oil can be obtained from under the salt.

The origin of the oil is doubtful. Two sources are possible: (1) the shales surrounding the domes or (2) from very deep-seated strata. The former explanation is favoured, and if this is correct it is considered that there is a possibility of production from structures other than salt domes.

A map showing the location of the known domes, the principal structural features, and the main outcrops, illustrates the paper. J. A. G.

605. Volcanoes of North-eastern Louisiana Account for Accumulation of Oil. H. D. Easton. *Oil & Gas J.*, 28.3.35, **33** (45), 28, 30, and 43.—As a whole, Northern Louisiana is a broad uplift (Monroe–Rickland), bounded on the south by the Angelina–Caldwell flexure, on the north by the Arkansas syncline, on the east by the Yazoo fault, on the west by the Monroe fault. The Sabine uplift at the western end is not a simple structure, but punctured in places by upthrusts and with many stratigraphical irregularities. This has been a zone of folding, faulting, intrusion and elevation, over long periods, and it is possible that no Palæozoic strata were deposited on it. Except for a few remnants of Cretaceous, the covering is of Tertiary beds. If no Palæozoics have been deposited and the salt beds are of Permian age only, then salt domes are not to be expected on this uplift.

East of the Monroe fault there is a normal sequence down to the base of the Midway, but that may rest on igneous rocks, a gas-bearing marl of Upper Cretaceous age, Palæozoics (Permian), or the oolitic pay-zone below the Glen-Rose anhydrite series. From just west of Monroe to the Sabine uplift a fairly regular series is encountered. The Monroe fault is probably the upper part of a more intense Palæozoic fault lying at right angles to the normal Palæozoic trend. The Amity fault is downthrown to the south-west and truncates the eastern end of a syncline. It is in general line with the Monroe fault, and has a similar throw. There is subsurface evidence of the Yazoo fault, the throw of which reverses in going northwards.

It is possible that oil may be obtained from local highs superimposed on the Monroe–Richland uplift, or from shore-line traps associated with it, and structures may be present at depth, but which give little or no surface evidence. J. A. G.

606. North Louisiana Surface Structure Evidence is Small. H. D. Easton. *Oil Weekly*, 25.3.35, **77** (2), 35–38.—Although no well in North Louisiana has gone through the lower Cretaceous, it is believed that the Jurassic and Triassic are missing, but it is held that the Permian (Red Beds) is present, and provides the salt for the domes of the coastal and interior areas.

Igneous activity during Cretaceous and later times is shown by beds of bentonite, but the vents are unknown. In a number of places oil or gas is found on top of or closely associated with igneous uplifts.

The Angelina–Caldwell flexure is considered as a possible (buried) continuation or extension of the Cincinnati arch. This runs from Angelina Co., Texas, to Caldwell, Louisiana. The northern side of the flexure is, on the whole, a great terrace, interrupted by two major structural features—the Sabine uplift at the western end and the Monroe–Richland uplift further east. That local and regional folding and faulting increase in intensity with depth has been proved in numerous instances. Thus the slightest surface structure may be expected to indicate more pronounced structure at depth.

The Monroe–Richland uplift, a north–south fault, constitutes a major structural feature, as important as the Sabine uplift. On the eastern side of the Monroe–Richland fault the sequence is normal down to the base of the Midway, but there are no upper Cretaceous beds. The Midway and younger beds are undisturbed, and thus the surface evidence does not reveal the presence of this fault.

Entirely in Longstreet, De Soto Parish, and with a north–south and east–west stretch of about 100 mls. the Wilcox (Eocene) is at the surface, and completely surrounded by Claiborne beds. This is the Sabine uplift, and around its margin is a great amount of local folding, faulting and puncturing. Movement has occurred repeatedly along this line, and many beds are therefore missing. A cluster of salt domes is present on the eastern flank of this uplift, similar to that on the Tyler syncline to the west of the uplift. With so many domes at or near the surface, many more may be expected at depth. None of these interior salt domes has been prospected because of the "feeling" that they will be unproductive, but the author believes that oil will be found around them.

Many of the deposits of North Carolina are of a shore-line nature, having been formed at times when the Gulf of Mexico advanced over this area. G. D. H.

607. Notes on the Petroleum Geology of Western Canada. A. J. Goodman. *J.I.P.T.*, 1935, **21**, 221–273.—A lecture with discussion on the general stratigraphy and orogenesis of the Canadian cordillera, the petrography, etc., of the foothills of Southern Alberta and the source and reservoir rocks of the oil and gas. G. R. N.

608. Eastern Venezuela Expected to Become Major Producing Area. G. R. Pinkley. *Oil Weekly*, 15.4.35, **77** (5), 37–39.—Within the area bounded by the Orinoco delta swamps, the mountains along the northern coast and the ancient mountain stumps south of the Orinoco, is a geological basin which is now attracting attention. The highlands are of igneous, Cretaceous, and Eocene rocks, and some Oligocene, but the Oligocene is usually overlapped by Miocene clays, sands and sandy shales, which form the lowlands of the central basin. The Pliocene seems to be unimportant, and great masses of Pleistocene sediments form the mesas of the "Llanos."

Geophysical work has been going on; aerial photography is proving valuable in conjunction with the ordinary methods of surface geological surveying.

At present the Quirequire field is the sole commercial producer in this province. Attention was first directed to it by a pitch lake at Guanoco, and two oil zones are now known. Oil is obtained from shore-line deposits of lower Miocene age, and it is thought possible that it might have originated in the underlying, folded and truncated, Oligocene black shales.

Some oil has also been found at Pedernales on the coast, but it cannot be separated from the flour sand. At Oriqual, ten miles west of Quirequire, a little oil was obtained from a lens on a small fold. G. D. H.

609. German Oil Situation. J. B. Eby. *Oil Weekly*, 25.3.35, **77** (2), 35.—On the Ostrup anticline, 100 mls. east of Hannover, oil has been obtained from a fractured dolomite of Middle Zechstein age, at a depth of 1742 ft. The oil is heavy, and a considerable thickness of dolomite remains to be tested.

25 mls. south-east of Hannover, a well on the edge of the Moelme salt dome found oil at a depth of 328 ft., and is producing 210 barrels of oil per day.

The new field at Bruchsal lies close to the main east fault of the Rhine graben and just within it. A small production has been obtained from lower Oligocene sands. G. D. H.

610. Effects of Geophysical Factors on the Evolution of Oil and Coal. D. White. *J.I.P.T.*, 1935, **21**, 301–310.—An article reviewing some primary phases of the origin of petroleum, attention being especially directed to some conclusions and implications resulting from the examination of the progressive metamorphism of the chemically organic sediments, including coals and the mother rocks of oil. The evidence reviewed is largely geological and circumstantial, rather than chemical. G. R. N.

611. Electrical Prospecting Methods Demonstrated. E. W. K. Andrau. *Oil & Gas J.*, 4.4.35, **33** (46), 137.—This article gives, in some detail, a report on the expansion of the Schlumberger electrical method of logging formations in the United States and the advantages obtained from its use. L. V. W. C.

Class 300. Development and Production.

612. Wire Line Core Drilling. L. T. Anderson. *Oil & Gas J.*, 4.4.35, **33** (46), 140.—A core drill has been developed which is lowered through the drill-pipe on a wire line. The bit is of regular fish-tail type with centre hole to accommodate the core barrel and centre bit. It can be used for drilling and coring any formation regularly drilled with a drag-type bit. A seat is provided inside the bit connection for the core barrel permitting circulation while the barrel is in drilling position. The bit operates on a forged drill collar attached to the drill stem by a special drill collar sub that carries or drives in the lower end for locking and driving the core barrel when in operating condition. Mud is displaced from the barrel through a valve as the core enters. For removing the core barrel an overshot is used. This overshot is attached to a solid steel overshot weight at the top of which is a regular wire-line socket. This overshot can be released from the head while the core barrel is locked in coring position by simply dropping a trip tube down over the wire line and over the overshot body.

When a core is desired, the kelly is removed and the core barrel assembly is dropped down through the drill stem to the bit, where it is automatically locked. Drilling is carried on until the required amount of hole has been made, and the kelly is then removed. The overshot is then run down on a wire line operated from an auxiliary reel. The overshot is run as rapidly as possible where it attaches itself to the spear-head. An upward pull on the line releases the core barrel. L. V. W. C.

613. Excess Core Recovery in South-West Texas. N. H. Stearn. *Oil Weekly*, 8.4.35, **77** (4), 21.—A new coring apparatus, the salient feature of which is an inner core-receiving tube held in place in the core head bit by the pressure of the drilling fluid, has been developed. This bit is so devised that when the receiving tube is full, or is plugged so that no more core can enter, it indicates to the driller that he is no longer taking core. This indication prevents the possibility of drilling on into lower formations when the expansion of the first part of the core has filled the core barrel before it has drilled its full length.

Instances of core expansion have been noted in coring with almost all types of core barrels, but the recovery is usually so imperfect that no quantitative idea could be derived of the importance or amount of core expansion.

A quantitative record of excess core recovery was compiled from data obtained when using this new type core drill, and it indicates that core expansion often causes unrecognized losses amounting to as much as one-third of the core cut.

In order to ensure more accurate results, the technique of coring must be developed with care to take account of this factor of expansion. L. V. W. C.

614. Unusual Rig Hook-up in South Texas. E. S. Post. *Oil Weekly*, 1.4.35, **77** (3), 32.—The major feature of this unusual rig hook-up is the draw-works and line shaft assembly. Three A-shaped frames are welded on to skids. On one side the draw-works was rigged up, and on the other side was mounted the line shaft. They were chain connected in the usual manner. Head-board and jack-post rigging as well as other contraptions necessary to operate the rig with this form of set-up were eliminated. A number of open chains have been eliminated by the use of pieces of casing cut in half and bent over the gears and chains.

Any part of the equipment can be inspected without leaving the floor when the rig is in operation. L. V. W. C.

615. Unique Type Rotary. Anon. *Oil & Gas J.*, 4.4.35, **33** (46), 146.—A new and unique rotary draw-works and power transmission unit has been undergoing tests recently. This draw-works embodies a number of mechanical principles which have been used successfully in heavy logging machinery for a number of years.

The outstanding feature of this apparatus is the mechanical means employed to obtain drum speed changes as well as rotary drive speed changes. A unitary system of band clutches is incorporated in a shielded and dust-tight housing behind the draw-works in place of the conventional jaw clutches. This unit permits a change of speed from high to low while under load and with engine running at full speed.

The drum is equipped with air-operated brakes of special design controlled by a variable air-pressure valve. Air-operated band clutches of the same type as used in

the transmissions are a part of the rotary drive, permitting instant reversal under full speed and load.

The machine may be taken down in five units for moving, and can be set up in quick time. L. V. W. C.

616. Double Draw-works Insures against Shut Downs during Critical Periods. Anon. *Oil & Gas J.*, 4.4.35, **33** (46), 136.—Double draw-works have been used on the new deeply-seated Bosco Field as a standard set up.

The chief purpose of having this auxiliary drilling equipment on a rig is to reduce the possibility of shut downs. Large sums are at stake in the deep wells being drilled, and stand-by auxiliary equipment is a vital benefit. L. V. W. C.

617. Steam-Turbine-Driven Mud Pump. Anon. *Oil & Gas J.*, 4.4.35, **33** (46), 144.—The application of steam turbines for driving mud pumps is finding a place in Gulf Coast drilling practices. Savings in available power have been accomplished by higher efficiencies in the utilization of steam and the consequent lowering of fuel consumption.

Flexibility is an important feature of the design, and the use of V-belts has provided this flexibility. L. V. W. C.

618. Small Diameter Casing Used Profitably at North Dale. E. S. Post. *Oil Weekly*, 25.3.35, **77** (2), 25.—Small-diameter casing employed in the South Texas area is bringing profitable results. The efficiency of the wells is not materially reduced through this plan.

The method adopted by one company was to run sufficient 4-in. perforated casing to allow drainage from the production horizon. Just above the perforated pipe was a "baffle" plate 4 in. in diameter, resting on the shoulder made by the end of the preceding joint of pipe. Into the collar at the top of the perforated pipe was screwed a swedged joint of 6¼- to 4-in. casing, in which several holes were drilled near the bottom.

A shoulder was left in the hole, and into this the swedged portion of the string fitted snugly.

The usual two-plug method of well cementing was used, and when the cement had hardened the cement and baffle plate were drilled out in the usual manner. L. V. W. C.

619. Reduction of Production Corrosion Losses Due to Selection of Equipment. W. F. Rogers. *Oil & Gas J.*, 4.4.35, **33** (46), 84.—Special attention is necessary to the problem of the rapid rate of corrosion experienced by equipment used in the production of oil. A detailed study has been made of the subject, in order to develop means by which the corrosivity of a well fluid could be accurately determined, and to evaluate the various materials which are offered as corrosion resistant equipment. The corrosivity of an oil-field brine can be determined to only a very small degree through analysis of the brine. It is still necessary to initially equip each well with the usual type of materials and wait for the corrosivity of the fluid to become obvious.

Development of corrosion resistant materials has made it possible to select equipment which can be used to reduce the costs as experienced when non-corrosive resistant equipment is used. L. V. W. C.

620. Study of Rotary Drilling Fluid. J. F. Dodge and A. C. Freitsche. *Oil & Gas J.*, 28.3.35, **33** (45), 131.—The importance of viscosity of drilling fluids and its measurement cannot be too strongly stressed. Control of this property will reveal not only the condition of the mud used, but will also indicate the conditions of the hole and will assist in obtaining the best possible drilling speed.

It is stated that changes in pressure alone will bring about only a very slight variation in viscosity. While temperature changes produce a U-shaped viscosity curve, extremely high temperatures applied to drilling fluids will result in the destruction of the colloidal properties and the destruction of the usefulness of the mud in drilling operations.

It is believed that, in general, viscosities should be kept as low as possible, and that the weight and quality of the mud should be frequently checked. Lower viscosities will allow high circulation rates without excessive heads and straining of the pumping equipment. L. V. W. C.

621. Application of Fibrous Materials to Drilling Muds. C. P. Parsons and H. L. McQuiston. *Oil & Gas J.*, 18.4.35, **33** (48), 50.—Among the troublesome conditions experienced in Fitts Pool, Oklahoma, is the forcing of salt water into the drilling mud, or the opposite effect of taking drilling mud and cement slurry out of the hole on the least provocation. There are four main effects of these formations: (1) loss of circulation while drilling, (2) inflow of salt water into the mud from supercharged shallow sands, (3) loss of cement slurry, and (4) escape of gas from shallow supercharged sands upward behind the casing.

The use of carefully selected sealing materials, for overcoming the loss of circulation while drilling and loss of cement slurry while cementing, has been successful.

A great deal of experimental work has been carried out with various materials. This work included a selection of various materials as to kind, shape and size that would be suitable for sealing, samples of permeable formations ranging from fine sand to very coarse gravel, mixtures of sealing materials and various drilling fluids, etc.

The physical properties of the drilling fluids and cement slurry were considered when mixing with sealing materials. In addition to covering the effects of these sealing materials on the physical properties within the mixture, the experiments also included sealing tests when different pressures were applied. The materials at Fitts Pool were based on the experimental work, and one important result realized was the overcoming quickly of the loss of cement slurry. The sealing material was added to the mud as soon as the formation commenced to take the drilling fluid until a seal was built up on the walls. L. V. W. C.

622. Colloids, Crystalloids and Jells are Playing an Important Part in Muds. C. B. Kennedye. *Oil & Gas J.*, 4.4.35, **33** (46), 89.—One of the most important subjects on the Gulf Coast is the conditioning of drilling muds.

Drilling mud with sufficient colloidal material, with water as the dispersing medium, will form a thin rubber glue-like wall, whilst a mud lacking in sufficient colloidal strength will form a much thicker wall before complete shut-off is obtained. The crystalloid structure wall, in addition to reducing the diameter of the drilled hole, is easily broken away by the drilling string, and frequently results in caving.

Admixtures and weighting materials must be thoroughly mixed before the materials are pumped into the well. If the mixture is not thoroughly mixed and stable, precipitation will occur and stick the drill pipe.

High viscosity muds are beneficial for most surface work, but cement channelling is almost sure to occur with such muds with low specific gravity and with a low viscosity high specific gravity and slurry.

Air or gas entrained affect viscosity, and indirectly the rate of gelation.

Heaving shale jobs have resulted in the carrying of too low a viscosity, to the detriment of colloidal content. L. V. W. C.

623. Engineers Now Apply Oil-Milling Principles to Treatment of Mud. N. Williams. *Oil & Gas J.*, 11.4.35, **33** (47), 17.—The deep drilling conditions in the Gulf Coast have caused operators to take more precautions to insure continuous and ample circulation of drilling fluid.

Suitable muds are provided, importance being attached to the elimination of sand and other undesirable materials, release of entrained gas and the mixing of the mud into a thoroughly homogeneous fluid of proper weight and viscosity. Equipment to perform these functions most efficiently are essential phases of modern mud systems.

Settling ditches have been given more attention, and vibrating screens have become necessary adjuncts to the mud systems of all wells.

A mud cracking process has been worked out by one company, whereby the returns from a well are directed into a combination surge and settling-tank. The incoming fluid, laden with cuttings, is forced by means of baffles to travel a circular direction entirely around the tank to a skimmer over which the fluid passes to the cracker. The cracker is a centrifugal machine which operates at high speed. This action breaks down the clays and shales, and mixes them with water into a homogeneous, stable and colloidal mixture and presses them through the screen.

Desanding has been carried out by means of a centrifugal separator, and weighting materials have been recovered by this means.

Auxiliary standpipes are included in the standard set up to ensure that there will be no interruption in the circulation due to possible breakage of the hose-pipe.

L. V. W. C.

624. Modern Methods Employed at Central Field Mud Plant. J. C. Albright. *Petr. Eng.*, March 1935, **6** (6), 99.—Various types of apparatus, with which the discarded mud is desanded, have been installed by a number of operating companies in California, and in the process of desanding some of the mud is recovered.

Early practice in the Ventura Avenue field was to pipe the mud when it became unsuitable for further work in the well to large slush pits to prevent contamination of the beaches. This was a costly procedure, and although large deposits of desirable clays, possessing the qualities required for rotary drilling mud, are available, it became necessary to salvage added ingredients such as weighting materials.

Special apparatus for reclaiming rotary drilling mud has been installed in the mud-mixing plant at Ventura. The used mud is received from the drilling wells after passing through vibrating screens at the wells, where all the large particles of shale and the coarser sand are removed. The mud still contains a percentage of fine sand that must be removed.

The new apparatus consists of two units, the first of which contains a vibrating screen through which the mud must pass to remove the sand and finely divided shale cuttings. The second unit is a centrifugal separator, and it is in this machine that the finely-divided particles are subsequently removed or the mud classified according to weight.

Diagrams are given to show the general arrangement of the screening and desanding equipment.

L. V. W. C.

625. Special Technique Used in Re-working Old Wells in the Gulf Coast Fields. M. L. Cashion and M. R. Reddick. *Oil & Gas J.*, 4.4.35, **33** (46), 96.—One of the most important developments in recent years as regards re-working wells is the use of oil, oil-base muds and special highly colloidal muds in screen pulling and perforating jobs. If the pressure is not excessive, it is found advantageous to wash the hole with oil or oil-base muds prior to pulling the screen. If the pressure requires a heavier fluid then highly colloidal, low viscosity mud of low gel strength should be used. The oil-base mud is preferable because the reduced hydrostatic head minimizes penetration.

After the screen has been removed, the sand should be under-reamed to remove the old cemented sand face, using oil-base mud. The hole is then washed to bottom with a bit, and the screen is run and set.

Corrosive-resistant strainers have been used for some time. The popular pipe is galvanized-steel or wrought-iron pipe with galvanized wire wrapped around it. This should increase the life of the well.

Various methods have been tried to prevent drilling mud passing through the strainer while washing, notably the use of cement-lined strainers and strainers filled with material impervious to water though soluble in oil.

The various types of wells on which re-working is being carried out are enumerated.

L. V. W. C.

626. Handling High-Pressure Wells in California. W. H. Sawdon. *Petr. Eng.*, March 1935, **6** (6), 51.—The experience gained in overcoming high pressures in California has enabled methods and equipment to be devised, and the success that has accompanied the drilling of these wells has testified to the value of these methods. Different areas have required different methods, but the methods now developed and the equipment now available should meet any problem of pressure control.

The handling of high pressures requires the use of proper equipment and mud control. The weight of the mud is not relied on for controlling the formation pressure, but drilling fluid control is still a factor, even when an external pressure is applied to the fluid column.

Mud control has been the means of completing a number of the deepest wells in California without costly blow-outs. Many companies are now using complete laboratory tests, and mud hydrometers are being widely used in place of mud weight recorders.

Central mud plants are used by many companies, and weight materials are added at the plant as well as at the well.

Blow-out preventers, both of the rotating and non-rotating type, are widely used. Many special types of drilling heads are being used while going through high-pressure zones.

Improvements have been made in the drilling equipment, and due consideration is being given to co-ordination between speed of drilling and control of pressure. Mud pump gauges are general, whether the control of pressure is by pressure drilling or by weighted mud. Tachometers are used to govern the speed of rotation, and this is co-ordinated with the weight held on the bit.

Hydraulic tables are being used extensively. L. V. W. C.

627. Completion by Pressure Control in Fitts Pool Permits Accurate Logging. L. G. E. Bignell, *Oil & Gas J.*, 28.3.35, **33** (45), 23.—A well in the Fitts Pool has recently been completed using the well-head control and high-pressure separator system while drilling into the producing formation. In this pool the bottom hole pressures range from 1425 to 1850 lb., and the average loss in pressure is reported as 0·7 lb./100 brl. of oil produced.

With these pressures it is obvious that the formation pressure is not sufficiently high to permit drilling-in with mud or washing-in with water.

The method adopted was to drill to the top of the Viola with the usual rotary outfit, and then to replace the ordinary turntable by the Hydril and hydraulic feed unit.

The slush pump speeds were varied to suit drilling conditions, and the proportion of gas added to the water reduced the average weight to about 5 lb./gal. With this weight a pressure of only 1140 lb./sq. in. was created at the bottom of a 4200-ft. string of drill pipe. There was thus a differential pressure in favour of the formation of about 700 lb./sq. in.

The well is sealed at the casing head, and a 4-in. line connects the well with a high pressure oil and gas separator. This separator permits all cuttings to be dropped as the flow from the well passes through it.

Accuracy of control is a marked advantage of this system. If the walls do not stand up well, the small amount of water used will not carry the cavings and cuttings to the surface fast enough to keep the hole clean. L. V. W. C.

628. Sand Tamped Method for Shooting Wells. F. W. Swift. *Oil Weekly*, 25.3.35, **77** (2), 17.—Operators in the Texas Panhandle are practising sand tamping of shots in shooting the oil-saturated lime.

The best material to use is unscreened sand containing gravel, none of which is larger than a hen's egg.

When ready to run the shot in the hole, ten shells filled with sand may be placed below the nitroglycerin shells. Above this the time bomb is run, and any space within the time-bomb shell that the bomb does not fill is filled with sand. On top of the time-bomb shell a bridge is made to support the sand tamp. The sand tamp is made by dropping fairly large pieces of rock until a height of some 7 or 8 ft. above the time bomb has been reached. The drilling tools should then be run into the hole carefully, and a mark made on the wire line so that a measurement of the amount of sand then put into the hole can be made.

After the bridge is formed on top of the shot, the sand is shovelled into the hole. The number of feet above the shot that the hole should be filled with sand will, of course, vary according to the size of the shot and the hole.

A number of advantages of sand tamping are cited. L. V. W. C.

629. Backside Crank Pumping. H. E. McCray. *Petr. Eng.*, March 1935, **6** (6), 66.—Backside crank-pumping equipment was originally looked upon as a temporary cost-saving measure, but the advent of such surface equipment as hook-offs, shackle rods, hold-ups and hold-downs, swings and jacks has shown that such pumping equipment, properly installed, is permanent and economical in operation. This is evidenced by the fact that in many instances three, four and occasionally more wells are being pumped with engines of the same power as was formerly used on a single-beam pumping well.

In one instance the present designs call for a central power plant, comprising heavy crankshaft, steel bandwheel with double cranks, bronze bushed jack post bearings with cranks attached to two double-end roller-type hook-offs. L. V. W. C.

630. Setting Screen in High-Pressure Wells on Gulf Coast. Anon. *Oil & Gas J.*, 4.4.35, **33** (46), 46.—The deep wells now being drilled in the Gulf Coast area have necessitated ways and means being devised for penetrating the deep sands and for setting liner and screen in such a manner as to assure successful completions.

The major problem in making satisfactory screen setting is to obtain a thoroughly clean washing of the face of the producing sand and of the outside of the well screen before setting liner packer.

Even with the most scientific drilling mud which can be employed to drill-in with, the producing sand is subjected to a mudding-off influence that can be offset by long and continuous washing with clear water or a suitable fluid. Several methods are available which will permit this operation to be carried out satisfactorily.

One method embraces the use of set shoes, liner packer and liner-setting equipment. A description of this equipment is given.

Several variations of the above method are in use, depending on the conditions of the well—that is, whether the formations are soft or whether high pressures are encountered.

Another method embraces the uses of a specially designed tubing head and correlated liner packer setting tool. A modification of this method has also been used.

L. V. W. C.

631. Methods of Pumping in Gulf Coast Area Vary with Individual Well. Anon. *Oil & Gas J.*, 4.4.35, **33** (46), 87.—In those instances where Gulf Coast wells have ceased to flow, serious consideration has become necessary of methods and equipment for the production and recovery of oil.

From a pumping point of view, it is becoming more obvious that each well is a specific, individual problem, and that the proper method of pumping and type of equipment most adaptable are to be determined by the particular problem of each well. Standardization of methods and equipment is impossible, and as a result a number of types of pumps are found in modern usage on the Gulf Coast.

On account of very loose sands, considerable trouble is experienced in wear on pump parts and in sanding up of wells. In addition, water is a big factor. Crooked holes present a serious problem in wear of rods and other equipment in coastal pumping wells.

Insert pumps are now being used more generally on the Gulf Coast than any other type. Fluid-packed pumps have gained considerable favour, since these pumps handle sand more satisfactorily and do not require the repairs and replacements of parts as in other pumps.

There is a decided trend in the use of gas lift. Various types of these lifts have been put in operation in a number of different coastal fields within the past couple of years. Straight chamber lifts, mixing chamber lifts and valve lifts have been brought out.

Several repressuring projects are being carried on. L. V. W. C.

632. Hendrick Field Remains Profitable. B. Mills. *Oil Weekly*, 6.4.35, **77** (4), 24.—The Hendrick Field of West Texas produces a higher percentage of water than any other major field in the world. An oil production of 17,000–18,000 brl. daily is obtained, with a water yield of 450,000–550,000 brl. daily.

The utilization of a combination of favourable production forces enables the field to maintain its status as an economic producer.

Series of flow, settling and storage tanks are provided, and with this system of tank separation oil from the wells flows to the top of a 15-in. vertical pipe flume placed on the outside of the 1500-brl. gun barrel. The flume acts as a kind of reservoir to prevent a few heavy producing wells from sending their flow direct to the tank.

Skimming from a series of pits is a fairly successful practice in some parts of the field.

The cost of handling water on a number of lines is negligible. L. V. W. C.

633. Locating Water Entry in Flowing Wells. W. A. Sawdon. *Petr. Eng.*, March 1935, **6** (6), 30.—An electrical method for locating water entry into a flowing well has recently been developed and successfully used to determine water sources of wells producing in various fields. The intensity of pressure in the well is immaterial as long as the well is flowing.

The principal function of the method, known as the "Droplet Counter," is to indicate the frequency of impinging droplets of water in a flowing column of oil, gas and water as they pass through a detector as it traverses the well. In addition, a dielectric is also recorded, and the variation of this dielectric value shows the changes in concentration of the fluid.

The recording operation is entirely automatic. The detector is run into the well on the end of an insulated cable, and the currents passing are led through a control box and recorded by means of an oscillograph. The impingement of droplets of water causes one oscillograph wire to oscillate, and the changes in concentration of fluid cause movement in the second wire. These oscillations are photographed on a film in synchronization with the travel of the detector in the well, thus allowing the depth indications to be recorded at the same time as the oscillations occur.

The procedure necessary in preparing the "Droplet Counter" is explained.

L. V. W. C.

634. Heaving Shale Problem. B. Mills. *Oil Weekly*, 1.4.35, **77** (3), 19.—No drilling method that will handle heaving shale under all conditions has yet resulted from the experiments carried out during the last eighteen months.

Shale strata are seldom uniform, and this fact alone has been sufficient to hinder the finding of an effective remedy.

Both mechanics and chemistry are involved in this problem, and the best results have been obtained where both these factors have been considered. The use of pressure-drilling equipment is a tribute to the importance of mechanics in tackling the problem.

A resumé of the various methods used is made. L. V. W. C.

635. Acid Treatment of Oil Wells. H. F. Wright and R. L. Ginter. *Oil & Gas J.*, 21.3.35, **33** (44), 53.—The paper presents results of studies made during the past two years. Consideration is given to porosity and permeability of various types of rocks, the method of accumulation and mode of occurrence of oil therein, and the factors bearing on the successful application of acid treatment. For application to limestone and germain rocks it is desirable to restrict the SO_4 content of the hydrochloric acid used to 0·3% in order to avoid clogging. The use of hydrofluoric acid in the treatment of siliceous limestone and limey sandstones is attended with difficulties in respect of insolubility of reaction products and the possibility of water-supply contamination. Experiments show that the rate of reaction is not speeded up by addition of nitric to hydrochloric acid when treating dolomites. Data concerning the effect of acid concentration on reaction rate are presented. Difficulties in inhibiting the acid and in the formation of a gelatinous coating on the surface of many limestones, thus retarding reaction, when using acid of high concentration, limit the usable concentration to about 14 or 15%. Disadvantages of heating the acid to increase rate of reaction, either directly or by employment of heat-generating chemicals, are outlined. Inhibitors capable of reducing metal losses to 0·003 lb./sq. ft. when used in concentration of 0·1–0·3% in 14% acid are available.

The radial influence of acid treatment is considered. It is not thought that increased production due to acid treatment is due to enlargement of the hole, but to reduction of flow resistance over a wide zone. Arguments in support of this view are given. It seems very doubtful whether the introduction of substances calculated to reduce surface tension can add much to the efficiency of treatment as now practised. In the newer fields, where advanced methods of production lead to high ultimate recovery, the use of acid may only shorten the time necessary for extraction of the oil, but in the older fields where redrilling or repressuring is economically impractical, or even in connection with repressuring, acid treatment furnishes a means of reviving and restoring production at a cost which is feasible for low yield of operations. Where successful, it is considered that acid treatment does increase ultimate recovery as well as rate of recovery. R. A. E.

636. Multi-stage Separator Installations. Anon. *Oil & Gas J.*, 4.4.35, **33** (46), 63.—An increasing need for separators has resulted from the development of a new type of field on the Gulf Coast. The wells in these fields produce a considerable volume of high-pressure gas with a content of light distillate.

A survey which has been made of the Gulf Coast fields where these conditions apply

indicates that separator hook-ups of at least three stages will be needed to obtain the highest degree of efficiency in operation and recovery.

Multi-stage separator installations permit the maintenance of sufficient pressure on the high pressure to strip effectively the gas passing from the separator. The recovered fluid and gas held in saturation under the high pressure of the separator is then discharged into the second separator, on which a somewhat lower pressure is held. Some of the lighter fractions in the fluid vaporize and pass off the top, to be recovered again as gasoline.

It is usually desirable to hold in the last separator, whether it be second, third or fourth, only sufficient pressure to boost the recovered fluid to storage.

L. V. W. C.

637. Bottom-Hole Chokes have Numerous Applications in Gulf Coast Wells. Anon. *Oil & Gas J.*, 4.4.35, **33** (46), 48.—The salt domes of the Gulf Coast are deeper seated the nearer they are to the Gulf, and as the depth of pay formations increases the ratio of gas to oil and the character of the oil materially changes. Near the outcrop the oils are heavy, and have low gas–oil ratios.

Expanding gas reduces the temperature of the surrounding medium of gas, oil or water and changes flow conditions. Where this occurs in a well that has its annular space filled with oil, it is common to find that the paraffin in the oil is precipitated in both tubing and the annular space. Where the space at the back of the casing is filled with water, freezing occurs, with consequent damage to casing. Where gas is present, cooling will cause precipitation of gasoline fractions. The most serious trouble is caused by freezing of the water.

If the gas can be expanded deep in the hole where the formation temperatures are sufficiently high and the volume of heating medium surrounding the tubing sufficient to furnish heat fast enough to satisfy the demands of the expanding gas, no trouble should be experienced in producing the wells.

Adjustable bottom-hole chokes are being used with success. Bottom-hole chokes and mixing valves are used in many connections, and one more use is as a plug when desired by using blank bean.

L. V. W. C.

638. Patents on Drilling Apparatus. R. C. Baker and C. E. Burt. U.S.P. 1,992,933, 5.3.35. Cement retainer.

A. H. Collins. U.S.P. 1,992,992, 5.3.35. Rotary roller bit.

J. J. Santiago. U.S.P. 1,993,182, 5.3.35. Hydraulic expanding reamer.

J. H. Bettis. U.S.P. 1,993,258, 5.3.35. Paraffin scraper for plunger lift devices.

L. Evans. U.S.P. 1,993,266, 5.3.35. Plunger lift device.

H. W. Fletcher. U.S.P. 1,993,269, 5.3.35. Pipe joint and method of construction.

F. L. Scott. U.S.P. 1,993,286, 5.3.35. Rotary bit.

H. B. Woods. U.S.P. 1,993,292, 5.3.35. Flow regulator for plunger lift pumps.

C. J. G. Aarts and J. A. A. Mekel. U.S.P. 1,993,641 and 1,993,642, 5.3.35. Apparatus for making bore-holes, comprising a pressure-resisting top chamber on top of the hole and a means for building up a gas pressure in the hole. Current conductors led to near the bottom of the hole and highly refractory electrodes connected to the lower end of these conductors and capable of dipping into the slag of the bottom of the hole.

J. C. Harris. U.S.P. 1,993,740, 12.3.35. Tool joint.

J. S. Morgan. U.S.P. 1,993,796, 12.3.35. Weight indicating rotary swivel.

L. Dillon and R. W. Phelps. U.S.P. 1,993,877, 12.3.35. Casing meter.

B. E. Gavin. U.S.P. 1,993,927, 12.3.35. Pipe clamp.

J. A. Hardcastle. U.S.P. 1,994,072, 12.3.35. Cementing plug.

C. E. Painter. U.S.P. 1,994,660, 19.3.35. Oil and gas separator valve.

E. J. Riley. U.S.P. 1,994,730, 19.3.35. Apparatus for cooling or heating oil.

G. H. Ennis. U.S.P. 1,994,762, 19.3.35. Electrolyte for use in testing wells used in conjunction with a dealcoholized molasses slop.

R. C. Baker. U.S.P. 1,994,846, 19.3.35. Combined shoe guide and bull plug for well casings.

R. C. Baker. U.S.P. 1,994,847 and 1,994,848, 19.3.35. Rotary core barrel.

C. E. Burt. U.S.P. 1,994,850, 19.3.35. Cementing and floating shoe for well casings.

R. Temple. U.S.P. 1,995,046, 19.3.35. Device for determining inclination of oil wells.

J. J. Fitzpatrick. U.S.P. 1,995,095, 19.3.35. Combined sucker-rod coupling and guide.

J. H. Howard. U.S.P. 1,995,388 and 1,995,389, 26.3.35. Core drill and disc bit.

C. E. Burt. U.S.P. 1,995,469, 26.3.35. Set shoe for well casings.

H. W. Morris. U.S.P. 1,995,997, 26.3.35. Storage tank filling neck cap and lock.

F. J. Hinderliter. U.S.P. 1,996,068, 2.4.35. Trip casing spear.

C. L. Walker. U.S.P. 1,996,132, 2.4.35. Drilling apparatus comprising hollow drill stem, a collapsible core bit and means for expanding bit.

H. E. Turner. U.S.P. 1,996,264, 2.4.35. Adjustable anchor for wells.

A. E. Carlson. U.S.P. 1,996,322, 2.4.35. Rock-drilling core bit.

G. A. Erwin. U.S.P. 1,996,370, 2.4.35. Hydraulic jar.

J. H. Howard. U.S.P. 1,996,922, 9.4.35. Bottom hole choke.

A. J. Penick and K. T. Penick. U.S.P. 1,997,152, 9.4.35. Casing head and blow-out preventer.

C. E. Reed. U.S.P. 1,997,345, 9.4.35. Roller cutter assembly for drilling bits.

A. J. Penick and K. T. Penick. U.S.P. 1,997,431, 9.4.35. Pack-off tool.

J. J. Seny. U.S.P. 1,997,436, 9.4.35. Well reamer.

G. A. Humason. U.S.P. 1,997,731, 16.4.35. Tubing head and blow-out preventer.

J. H. Childress. U.S.P. 1,998,074, 16.4.35. Flow control device.

W. L. Church. U.S.P. 1,998,075, 16.4.35. Sample-taking apparatus.

W. E. Annin. U.S.P. 1,998,214, 16.4.35. Rotary jars.

L. B. Collins. U.S.P. 1,998,803, 23.4.35. Compound foundation for the drilling of a number of wells from the same foundations.

W. J. Flury. U.S.P. 1,998,804, 23.4.35. Inside casing cutter.

A. B. Crowell. U.S.P. 1,998,833, 23.4.35. Cementing guide.

R. J. S. Piggott and G. W. Ruster. U.S.P. 1,998,996, 23.4.35. Bottom-hole pressure bomb.

C. E. Reed. U.S.P. 1,999,131, 23.4.35. Roller bit.

C. E. Reed. U.S.P. 1,999,132, 23.4.35. Reamer

L. V. W. C.

Class 400. Transportation, Storage and Distribution.

639. Pipe-Line Practices and Problems in Western Kansas. F. H. Love. *Petr. Eng.*, March 1935, **6** (6), 27.—Among the factors giving rise to pipe-line problems in Western Kansas are widely scattered pools, level nature of the country, which makes gravity lines impossible, and hydrogen sulphide content of crude in certain areas.

The general practice in this area is to use light equipment, easily and inexpensively installed, which can be moved to another location quickly when depleted production makes it advisable.

A larger number of field booster stations have been installed in this area in proportion to its production than in any other Mid-Continent area, on account of the flatness of the country.

The predominant type of equipment for field boosters consists of gas engines driving reciprocating pumps and electric motors powering the same type pump. The sizes of the engines naturally vary with the companies.

The field boosters are placed within a few hundred feet of, and slightly below, the tank batteries, so that the crude gravitates to the pumps.

The corrosive nature of the crude causes considerable trouble in Western Kansas in the operation of diesel engines. In addition, California redwood tanks are used for storing this " sour " crude. L. V. W. C.

640. Testing for Pipe-line Soil Corrosion in California. J. C. Albright. *Oil Weekly*, 8.4.35, **77** (4), 29.—Two principal methods for the determination of soil corrosivity are used in Southern California. One is used extensively when making field tests, the other is used in the laboratory.

The field or rod method shows results immediately. It consists of two rods, made of steel and sheathed with bakelite except the lower points. One rod has a special handle containing two small flashlight dry cells. An earth-resistance meter is attached to this rod at the handle, which measures directly the resistance of the soil

at the depth the tips are buried. A circuit is completed by connecting the top of each rod with a suitable insulated wire.

Two methods are used with this rod; one is termed the "dry test" and the other the "wet test." The dry test consists of measuring the resistivity of the soil with its normal moisture content at the time the test is made. With the wet test two ounces of water are poured into each hole, and the rods inserted after the water has been allowed to stand about 5 minutes.

Several sources of error occur in the investigations of the corrosivity of soil by field tests: (1) spotty soil, (2) human element, (3) irrigation.

The laboratory method is known as the "Nipple and Can" system. Samples of the soil in which the pipe will be laid are gathered and put through a four-mesh sieve. A certain amount of water is then added. The nipple is weighed accurately to the second decimal point in grams, and is then placed in a prepared can, and the space around it filled with the wetted soil. The positive terminal of a six-volt battery is connected securely to the test nipple with adequate wiring, and the negative terminal connected to the exterior of the can.

After 24 hours the current is disconnected, the test nipple removed and cleaned of soil. It is then weighed, and the loss in weight calculated by comparing the new weight and the weight after being put through the soil test. This loss in weight is the corrosion index for the soil sample. L. V. W. C.

641. Pipe-line Joint Protection. J. C. Albright. *Oil Weekly*, 25.3.35, **77** (2), 31.—A means for joint protection has been developed by California pipe-line companies in keeping with their corrosive protection programme for transmission systems.

After the joint has been assembled, it is cleaned thoroughly with a wire brush until no slag or scale adheres to the metal. A thin priming coat is applied with a brush while the joint is still warm. One coat of asphalt is applied over the entire joint by using the "sewing strip" method while the hot asphalt is poured over the joint on the top surface. Fabric wrapper is applied in a spiral with the edge overlapping between one-fourth and one-half inch, with the underlying asphalt squeezed through the mesh of the fabric. After another coating of asphalt is applied, the asbestos is placed over the joint and a further coat of asphalt given. A final protective wrapper of heavy kraft paper is placed in position while the asphalt is still warm. L. V. W. C.

642. Soil Stress in Pipe-line in California. J. C. Albright. *Oil & Gas J.*, 1.4.35, **77** (3), 33.—The determination of soil corrosivity has been standardized by the majority of pipe-line companies transporting oil and gas in Southern California. These companies have found that some solids require a pipe coating of a particular nature and application, whilst others may permit pipe to be laid with a lighter protection.

In addition to corrosivity of the soils traversed, soil stress has exerted considerable influence, causing protection coatings to crack and be pulled from the surface of the pipe.

Specifications have been adopted for pipe-line coatings as a result of a series of tests carried out by the Los Angeles Gas and Electric Company using soils which were known to possess considerable shrinking properties.

The results of these tests are given, together with a chemical and physical analysis of the various wrappers employed for coating the pipes. L. V. W. C.

Class 500. Properties and their Determination.

643. An Accurate Ebullioscopic Method for Determining the Molecular Weights of Non-Volatile Petroleum Fractions. B. J. Mair. *Bur. Stand. J. Res.*, 1935, **14**, 345–357.—The determination of the molecular weights of lubricating oil fractions within $\pm$ 1% was necessary for an investigation of their chemical nature.

The cryoscopic method generally used is likely to give incorrect results due to (*a*) the formation of mixed crystals, (*b*) large deviations from the ideal freezing-point law, especially when solvent and solute possess dissimilar chemical natures.

The ebullioscopic method was considered likely to give more trustworthy results.

A modified Cottrell boiling-point apparatus with a differential thermo-element was

used for determining the accurate values for the boiling-point elevations. The behaviour of *n*-nonacosane, anthracene, triphenylmethane and two oil samples in benzene, *n*-heptane and "*iso*octane," and of biphenyl in benzene, was investigated.

The ebullioscopic constant K or the apparent molecular weight was shown to be a linear function of the concentration, and thus the usual method of calculation gave erroneous results.

Accurate values may be obtained if K at infinite dilution is first determined by extrapolation from measurements made over a sufficient range of concentrations.

By this method the average value for the molecular weight of triphenylmethane in the 3 solvents used was 243·4 (theoretical value 244·14) and for biphenyl in benzene 153·7 (theoretical value 154·08). D. L. S.

644. Boiling point–Gravity Constant of Lubricating Oils. E. A. Jackson. *Oil & Gas J.*, 21.3.35, **33** (44), 16.—A mathematical equation has been set up expressing the relationship between boiling points and gravities of various petroleum fractions. The equation is logarithmic, and expresses the A.P.I. gravity in terms of 50% boiling point and a constant which is different for each crude and is characteristic of it, being low for paraffinic and high for naphthenic crudes. Unlike the viscosity–gravity constant, it can be applied to non-viscous as well as viscous oils. Gravities of successive cuts from seventeen crudes were plotted against 50% boiling points, correcting those obtained at 10 mm. pressure in accordance with O. G. Wilson's chart. Four crudes representative of extreme and intermediate groups were selected, and the relations plotted on semi-logarithmic paper. Four converging straight lines were obtained, showing all curves conform with the general equation (1) $G = B + K \log T$, where G = A.P.I. gravity, T = 50% boiling point in °C., B and K are constants. The slope of the line for Winkler crude indicates variation in naphthenicity of different fractions of the crude. When the values of B and K were determined by Lipka's method and plotted against each other, it was found that they fell on a straight line. Solving the equation for this line, equation (1) may be re-written $G = B + (68 - 0{\cdot}703B) \log T$ (2).

The value B is the boiling point–gravity constant. An alignment chart is given. This permits rapid estimation of the constant from the boiling point and gravity data. A table gives the values of the boiling point–gravity constant and the viscosity–gravity constant of successive fractions of the four crudes selected. The values B for the four crude oils are: Buckeye 171·5, Mid-Continent 178·6, Winkler 186·0, Spindeltop 194·5. R. A. E.

645. Activity Coefficients of Gases. R. H. Newton. *Ind. Eng. Chem.*, 1935, **27** (3), 302.—The ratio of the fugacity to the pressure of a gas (termed the "activity coefficient") is an important function in dealing with high-pressure equilibria, including both phase and chemical equilibria, in that it furnishes a convenient method for calculating the fugacity. The fugacity of a gas in a mixture is equal to the activity coefficient multiplied by the partial pressure of the gas, and the activity coefficient may be calculated from an equation of state or by a graphical treatment of the P–V–T data. Of the two methods the latter is preferred, since it is well known that no equation of state accurately represents the P–V–T behaviour of gases over wide ranges. The activity coefficient $\left(\frac{f}{P}, \text{or } \gamma\right)$ may be represented as a function of the reduced pressure and reduced temperature only, and it would appear that γ is not very sensitive to slight differences in the surfaces of state. Previous workers have calculated γ for a limited set of conditions, thus—hydrocarbons having more than three carbon atoms per molecule, a pressure range up to ten times the critical pressure, and a temperature range up to 1·5 times the critical temperature. The author proceeds to extend and apply this correlation to the existing data for a large number of gases, etc., including argon, nitrogen, oxygen, methane, carbon dioxide, ethylene, ammonia, hydrogen, neon, helium, dichlorodifluoromethane, methyl chloride, water, sulphur dioxide, *n*-hexane, acetylene, *cyclo*hexane, *iso*pentane, nitric oxide, krypton, methanol, ethanol, and ethyl ether. Agreement between observed and calculated values of γ was close. With helium, hydrogen and neon an arbitrary function of the reduced temperature and reduced pressure was used, defined by $T_n = \frac{T}{T_c + 8}$

and $P_a = \frac{P}{P_c + 8}$, to bring the activity coefficients of these gases into line. Curves for the activity coefficient plotted against P_r at various values of T_r are given for the entire known range of T_r and P_r, *i.e.* 0·70–35·0 for T_r and zero to 100 for P_r.

E. N. H.

646. Thermal Reactions of Benzene. F. C. Mead and R. E. Burk. *Ind. Eng. Chem.*, 1935, **27** (3), 299.—Benzene was decomposed thermally in the temperature range 750–852° C. using a flow apparatus with a specially designed silica heating tube. A detailed description of the apparatus and experimental procedure is given. Under the conditions of these experiments the data obtained could be represented by the equation $\frac{dx}{dt} = \frac{k(a-x)^3}{x}$ or in its integrated form :—$kt = \frac{x}{a-x} + 2{\cdot}3026 \log \left(1 - \frac{x}{a}\right)$. This is in agreement with a bimolecular surface reaction strongly retarded by products. These results appear to be contrary to the statements of other workers. Steel was found to catalyse the reaction.

The plot of log k against $\frac{1}{T}$ gave a straight line, the slope of which indicated an apparent energy of activation of 50,000 calories.

The products of the reaction consisted of diphenyl, *p*-diphenylbenzene, and a small amount of higher condensation products of benzene together with hydrogen, acetylene, a small amount of other unsaturated gases and methane in the gaseous phase. The ratio of weight of gases formed to weight of solids formed was found to decrease with increasing partial pressure of benzene at a given temperature. At the lower temperatures no carbon was deposited, and even at 852° C. the carbon deposition was small in amount.

Reaction rate did not increase in proportion to the increase in surface, and the authors offer no satisfactory explanation of this. E. N. H.

647. Flame Temperatures Vary with Knock and Combustion Chamber Position. G. M. Rassweiler and L. Withrow, *J.S.A.E.*, 1935, **36**, 125–133.—The authors have made use of the sodium line reversal method for the measurement of flame temperatures, but whereas previously published work of various authors gave data from one position only in the combustion chamber, the present work gives results from three positions, viz. near the ignition point, near the centre of combustion space, and in the region where the last part of the charge burns. The apparatus used consisted of : (1) a single cylinder L. head engine of $2\frac{7}{8}$ in. × $4\frac{1}{2}$ in. stroke fitted with windows on opposite sides of the combustion chamber; (2) a continuous light source; (3) an optical system for directing the light through the engine to a spectroscope; (4) a spectroscope; (5) a stroboscopic shutter; (6) an optical pyrometer; (7) a pressure indicator. The engine conditions were as follows for all experiments: 800 r.p.m. 15° adv. spark, 12–1 mixture ratio, 212° jacket and full throttle. The mixture ratios were determined by exhaust gas analysis. Many graphs are reproduced showing temperature against crank angle at different positions with knocking and quiet running fuels. The results show that after the flame front passes a given point, the temperature rises until shortly before maximum pressure is reached. When the charge is completely inflamed, there is a temperature gradient right across the combustion space, the temperature at the spark plug end being sometimes as much as 600° F. higher than at the other end. With a knocking fuel it is found that the maximum temperatures are higher, and occur earlier, the rate of cooling during expansion is greater and the exhaust temperatures are lower. The actual temperatures recorded do not agree with those of other observers, whose figures have been both higher and lower, probably due to different types of engines and conditions employed. Comparison with published work in bombs is made, and the relationship between temperature and luminosity of the burning gases is fully dealt with. C. H. S.

648. Critical Phenomena in the Oxidation and Self-Inflammation of Hydrocarbons. M. Neumann and B. Aivazov. *Nature*, 1935, **135**, 655–656.—In 1933 Townend and Mandlekar showed that there was a sharp reduction in the self-inflammation temperatures of mixtures of air and hydrocarbons on reaching a certain pressure. They advanced a tentative hypothesis in which ignition at the higher temperature was due

to the thermal decomposition of intermediate compounds, whilst that at the lower temperature would occur when conditions favoured the survival and further oxidation of these bodies.

The authors advance another hypothesis which indicates that the velocity of oxidation of the hydrocarbon should increase rapidly with temperature over a wide range of pressure, and should then pass through a maximum into a region of negative temperature coefficient. On further increasing the temperature the velocity should again increase.

This theory was tested by studying the velocity of oxidation of pentane and oxygen in quartz vessels at various pressures below the ignition limit over temperatures 300–500° C. A series of curves are presented which seem to substantiate this theory, and which predict the two regions of thermal ignition with increasing pressures which have been observed by several workers. D. L. S.

649. Detonation and Pseudo-Detonation. M. Serruys. *Ann. des Comb. Liq.*, 1935, **10**, 142–145.—The author directs attention to the indiscriminate use of the words "détonation," "cliquetis" and "cognement," each being used to designate true detonation, and describes an occurrence, noted during experiments on supercharging, which he considers supports his theory of detonation (cf. abstract 1132, 1934).

With a water jacket temperature of 80° C. and progressive increase in spark advance, the onset of true detonation was preceded by rough running characterized by a dull "thump," quite unlike the metallic noise of true detonation. With a jacket temperature of 40–50° C., true detonation followed immediately upon silent running. Indicator cards showed for the intermediate state that at the end of combustion a rapid pressure rise occurred, followed by pressure waves of frequency corresponding to that of the audible noise. This effect was traced to a fault in the water passages of the jacket, which had given rise to a hot spot in the cylinder wall. The engine did not fall off in power, and no excessive heating occurred. It is suggested that the S. 30 engine is particularly prone to this pseudo-detonation, and that apparatus of the bouncing pin type, by reason of its big inertia, will respond more to pseudo-detonation than to true detonation. The author is developing an indicator based on the second differential of pressure with respect to time, with a natural period of one-thirty-thousandth of a second, which appears very responsive to true detonation, but not to pseudo-detonation. W. E. J. B.

650. Flame Movement and Pressure Development in Gasoline Engines. C. C. Minter. *J.S.A.E.*, 1935, **36**, 89–94.—The author makes an analysis of the phenomena of "rough running" in gasoline engines. The time required to burn a charge in an engine is proportional to the volume to be burnt, and for this reason the question of rough running is becoming more and more important as combustion chambers continue to get smaller, due not only to increasing compression ratios, but also to the increasing number of cylinders for a given total capacity. It is generally agreed from various bomb experiments that flame speed goes through a maximum at about the midpoint of its travel. The author considers the main problem in designing a "smooth" combustion chamber is to ensure that maximum pressure be developed as soon as possible, and stresses the importance of Janeway's work, which deals with the question of volume distribution around the point of ignition. Many curves are given which show the relation between flame travel and volume burnt in bombs of different shape, and an appendix gives formulæ for calculation of flame speed, and the relation between pressure and volume of combustion products. C. H. S.

651. Synthesis of Tetratriacontadiene. M. V. Dover and C. J. Helmers. *Ind. Eng. Chem.*, 1935, **27**, 455.—The paper discusses the relation between lubricating value and oiliness, and is the beginning of an attempt to gain definite knowledge as to the cause of oiliness in relation to chemical structure and lubricating value by the preparation of pure hydrocarbons of varying structure, size and degree of unsaturation.

Tetratriacontadiene, $C_{34}H_{66}$, was synthesized by electrolysis of a dilute alcoholic solution of potassium oleate. The product was freed from the major impurities by solvent extraction, but absolute purity was not achieved owing partly to the presence of some saturated hydrocarbons formed during electrolysis.

Fractional distillation under reduced pressure (1 mm.) results in partial decomposition, but a distillate fraction (average mol. wt. 278) and a residual oil (average

mol. wt. 612) were obtained and examined together with the original oil, which had an average mol. wt. of 444 compared with the theoretical value of 474. Various chemical and physical properties, including coefficients of friction by the Herschel machine, are tabulated. F. E. A. T.

652. Properties of 1-Octadecene, *n*-Octadecane and Di-*m*-tolylethane. M. V. Dover and W. A. Hensley. *Ind. Eng. Chem.*, 1935, **27** (3), 337.—Three hydrocarbons, 1-octadecene, *n*-octadecane and di-*m*-tolylethane have been synthesized and examined as part of a programme: (1) to synthesize a number of hydrocarbons the properties of which would resemble those of lubricating oils of low viscosity and (2) to study the chemical and physical properties of these hydrocarbons to determine whether or not any of these properties are related to "oiliness."

The number of hydrocarbons studied was not large enough to permit a final decision to be made concerning the "oiliness" of the various series of hydrocarbons. The small difference between the coefficients of friction given by 1-octadecene (0·106) and *n*-octadecane (0·096) would indicate that unsaturation is not an important factor in "oiliness." Previous evidence on this point is divided. Di-*m*-tolylethane gave a high coefficient of friction (0·230), suggesting that diphenyl-substituted paraffins are deficient in the property of "oiliness"; this is in agreement with previous investigations. There was no indication that any physical property is directly related to the property of "oiliness." With a single exception, however, a parallel was found between the dielectric constant and the coefficient of friction. From the evidence, it appeared probable that the straight-chain hydrocarbons possess the property of reducing friction to a greater extent than the cyclic hydrocarbons. E. N. H.

653. Chlorination of Methane. Z. Tomasik. *Przem. Chem.*, 1934 (10–12), 598–603.—The chlorination of methane with air and hydrochloric acid in the presence of Cu_2Cl_2 as catalyst has been investigated. The dependency of yield on temperature, the velocity of the gas, the position of catalyst, and the dimensions of pipes have been studied. It has been observed that it is possible to influence the reaction so that either chloroform or carbon tetrachloride or chloro-compounds of the homologues of methane can be obtained. Experiments have been made first on a smaller and then on a larger apparatus, the latter making it possible to obtain chlorine derivatives in quantities amounting to about 0·5 kg./hour. E. F.

654. Use of Physical Constants in Determining the Composition of Fuels. M. Marder. *Oel u. Kohle*, 1935, **11**, 150–152. (See Abstr. Nos. 426, 520, 533.)—To measure parachors, great accuracy is required in surface-tension measurements. The suspended level apparatus of Ubbelohde is recommended as most suitable. From experimental results of mixtures of synthetic hydrocarbons and a mixture of benzine with the latter, it is concluded that the parachor of benzine is an additive property of the constituent hydrocarbons; although oxygen and nitrogen compounds cause deviation from the mixture rule, they are present in such small amounts that the effect may be neglected. The refraction of benzine mixtures also obeys the mixture rule. C. C.

655. Michigan Crude. G. Egloff and E. F. Nelson. *Oil & Gas J.*, 28.3.35, **33** (45), 63.—The results of laboratory tests on a wide range of Michigan crude oils are tabulated, together with data on the yields and properties of products from these crudes. The crudes examined were fairly similar, giving: 22–26% by vol. gasoline (E. pt. *ca.* 325° F.) 8–11·5% naphtha (325–400° F.), 19–27% kerosine (400–600° F.), 12·5–14% gas oil, 9·5–13·0% lubricating distillate and 13–20% residuum. The octane values of the gasolines were generally low (33–59), so that reforming is necessary.

An analysis is given of Mount Pleasant crude, which is of highly paraffinic type. The yields and octane number of gasolines of end-point 275° F., 325° F. and 400° F. were: 15·9% (O.N. 51), 23·5% (O.N. 40), 35·9% (O.N. 22), respectively. Reforming of the 400° E.-pt. gasoline increased the octane no. from 22 to 51–67 (varying inversely as the yield of gasoline—81·6–63·9%). Cracking Mount Pleasant residue (41% of crude) produced gasolines of end-point 385° and 400° F. of O.N. 65–66 and 64–65, respectively, the yields under different cracking conditions being 49·6–54·4% and 43·5–59·1% respectively.

Similar analyses on Hart crude indicated the higher anti-knock value of the gasoline as compared with that of Mount Pleasant gasoline. Yields of 21·3% of

325° F. E.-pt. gasoline of O.N. 57 and 32·4% of 400° F. E.-pt. gasoline of O.N. 44 were obtained. Cracking Hart fuel oil (69% of the crude) gave 51–62% of gasoline of 65 O.N. with 40–25% of residue. C. L. G.

656. Bolivian Crude Oil. J. R. Reyes. *Petr. Times*, 23.3.35, **33**, 362.—Almost all Bolivian crude oil is of paraffin or mixed base type. Its properties are briefly: Sp. Gr. at 60° F., 24·6°–43·2° Bé.; Viscosity Engler at 50° C., 75–85 secs.; Sulphur Content, 0·2–1·5%; Distillation, I.B.P. 60° C., F.B.P. 200–300° C.; Colour, reddish or greenish-brown with a green fluorescence. H. G.

657. Properties of Propane. W. N. Lacey and B. H. Sage. *Oil & Gas J.*, 14.2.35, **33** (39), 49.—Specific volume curves for temperatures of 70°, 190° and 220° F. and absolute pressures up to 1000 lb./sq. in., and deviation factors for the same ranges of pressure and temperature are given in the form of charts. To enable calculations to be made in respect of storage of propane in pressure containers, thermal expansion curves for the temperature range 60–180° F. and pressures up to 3000 lb./sq. in. are given.

Another chart shows specific heat at constant pressure. The data are combined in a temperature–entropy chart, based on an arbitrary value of the total heat and entropy of saturated liquid propane at 60° F. of zero. For ease of reference for practical application a throttling curve and one showing work required for adiabatic compression from 25, 50 and 100 lb. respectively at 60° F. are presented.

R. A. E.

658. Nienhagen Natural Gas. Anon. *Chem. Ztg.*, 1935, **59** (13), 136.—During the period 1913–1916 Neuengamme near Hamburg produced 19–20 mill. cu. m. of natural gas (nearly pure methane). Gas of this type should yield 75% of carbon black theoretically, but only 2–3% of good-quality material with a certain size of grain and without tarry constituents is obtained. In 1926 the Gewerkschaft Elwerath erected a natural-gas gasoline plant at Nienhagen for about 30 cu. m./min. of gas containing 80% CH_4, 15% homologues, 4·5% N, 0·5 CO_2, no unsaturates. Bottled gas is produced by means of a three-stage equipment, the first step being absorption by active carbon, in the second stage the mixture of hydrocarbons is expelled by water vapour, whereby a very enriched gas is produced. This is liquefied by pressure, then fractionated under pressure for producing either a mixture of propane and butane for motor fuel purposes, or propane and butane are obtained separately.

L. S.

659. Natural Gas in Austria. L. Teissl. *Ztschr. Oest. Ing. Arch.*, V. 1935 (7/8), 46.—The bore-holes of the European Gas and Electric Company at Oberlaa near Vienna yield 80,000 and 10,000 cu. metres of gas per day from a depth of 260 m. The gas is conducted by pipe-line to the Simmering power station for firing its boiler plant. The gas contains: CH 95·9%, H_2 2·7%, CO 0·3%, N 0·8%, H_2S 0·1%, CO_2 0·1%, O 0·1%, gr. 0·71/cbm./° C./760 mm.; calorific value 8400–9232 cal. 1 cbm. yields 10·5 kg. water vapour. An auxiliary Körting (water-vapour jet) burner prevents the possibility of gas explosions. L. S.

660. Colour Stabilization of Gasoline by Amines. L. V. Storg. *Nat. Petr. News*, 20.3.35, **27** (12), 24; *Ind. and Eng. Chem.*, Ind. Ed., 1.2.35, **27** (2), 156.—The normal aliphatic amines up to and including the amyl amines are shown to possess colour stabilizing properties. While the amino-group is probably responsible for the stabilizing action, its effectiveness appears to be modified by the length and number of alkyl groups attached. The amyl amines are the most efficient, and of these the primary and secondary are the best. Optimum results are obtained with an amine concentration of 0·003%. The natural colour stability of a gasoline does not greatly affect the amount of amine necessary, but the maximum improvement obtainable varies with it. Little difference was noted between treating before and after sweetening, but since the lighter amines are slightly water soluble, there is some danger of loss if they are added before sweetening. H. G.

661. Pure Hydrocarbon Standard for Evaluating Inhibitors. C. G. Dryer, C. D. Lowry, G. Egloff and J. C. Morrell. *Ind. Eng. Chem.*, 1935, **27**, 315.—The article describes a standardized method of rating the efficacy of inhibitors by means of a pure hydrocarbon, *i.e. cyclo*hexene. As a measure of inhibiting value, the "*cyclo*-

hexene number" is proposed; it is the number of minutes by which the induction period is increased due to the addition of 0·002% of an inhibitor. It may be calculated from tests made on reference gasolines the relationship of which to *cyclo*hexene has been determined by standardization with α naphthol. The concentration of 0·002% of inhibitor in *cyclo*hexene was selected, as it shows definitely the effect of weak inhibitors, and yet does not give inconveniently long induction periods with highly efficient antioxidants. *cyclo*Hexene numbers are given for forty-one representative inhibitors. *cyclo*Hexene is sufficiently stable to be handled conveniently, it is inexpensive and a single fractionation of the commercial product yields a material of a boiling range of less than 0·1° C. It has an induction period of 45 minutes, and when free from peroxides, gives reproducible induction periods with inhibitors.

In view of the insolubility of some inhibitors in gasoline, they must be added to motor spirit in solution in a suitable solvent. Data are therefore given which show the effect of solvents on the action of a wood-tar inhibitor. W. H. T.

662. Colour Stability of Gasolines.—Effect of Mercaptans, Alkyl Disulphides and Sulphur. G. Egloff, J. C. Morrell, W. L. Benedict and C. Wirth. *Ind. Eng. Chem.*, 1935, **27**, 323.—An investigation has been made of the independent and combined effects on colour stability and haze formation of mercaptans, disulphides and elementary sulphur when present in straight-run and cracked gasoline and their blends. Colour determinations were made by means of the Saybolt colorimeter, and haze was observed by looking through the bottle on a black base towards north light. Colour stability was estimated by the exposure of 100-ml. samples in vented 4-oz. glass bottles, to the light from a carbon arc lamp, 15 minutes' exposure being equivalent to 2 hours' sunlight. The samples were straight-run and cracked Mid-Continent and Pennsylvanian gasolines. The results of the work showed that mercaptans had no effect on Mid-Continent gasoline, but that they slightly decreased the stability of Pennsylvanian cracked and blended spirits. Both colour and haze formation were observed with the straight-run product. Alkyl disulphides caused colour and haze formation in all the samples, but the effect was less pronounced in cracked than in straight-run gasolines and less in Pennsylvanian than in Mid-Continent products. Different disulphides showed different effects with Mid-Continent gasolines, but the same effects with Pennsylvanian. Sulphur added alone or in excess during plumbite treatment caused marked colour and haze formation, the effect being more pronounced with cracked spirits. Removal of excess sulphur after plumbite treatment improved colour stability and increased the time before haze appeared. This effect was also more pronounced in cracked than in straight-run spirits. Sulphur and disulphides in all samples except Pennsylvanian cracked gasoline had a more deleterious effect on colour stability than when present separately. Removal of sulphur and disulphides stabilized the colour. Contact of sulphur and mercaptan-free gasolines with plumbite solution did not affect colour stability, but treatment of plumbite sweetened gasoline with fuller's earth (1 lb./brl.) did not stabilize colour even when excess sulphur was removed. Haze could be removed by filtration through filter paper, and colour was also improved by this means, straight-run gasoline showing marked improvement, almost returning to its original colour. It is apparent therefore that the colour of unfiltered samples was due to suspended particles. Filtration of cracked spirit clarified, but only slightly improved colour, this showing that the colour produced on exposure is largely due to soluble coloured compounds. W. H. T.

663. Some Electrical Properties of Ceresin Wax. A. Wikstrom. *Physics*, 1935, **6**, 86.—A study of ceresin wax when subjected to a constant voltage was made in view of the extensive use of this material in research laboratories for insulating purposes, and the frequent troubles due to soakage currents which prevent constant conduction current being reached over a period of hours.

The construction of the test condenser with ceresin dielectric, and the apparatus employed are described. The quantities measured were :—

1. Total current i_t *vs* time t for different values of voltage E.
2. Discharge current i_d *vs* time t for different values of time T during which the voltage E was applied to the dielectric.
3. Polarization P *vs* charging time T.

Experimental procedure is described, and preliminary tests showed the volume resistivity of paraffin to be much higher than that of ceresin, although comparative figures were not obtained. A minimum value of $1{\cdot}76 \times 10^{19}$ ohm-cm. was obtained for the resistivity of commercial ceresin for a voltage gradient of 2000 volts per cm. at 23° C. and a sample thickness of 0·214 cm.

The charge accumulated in the dielectric during a charging time T is shown to be directly proportional to the applied voltage for constant values of T.

The variation of P/E with time was found to be independent of the voltage E, although this finding is questioned in view of the inherent inaccuracies of the method employed.

It is suggested that the characteristics of the ceresin depend on previous thermal treatment of the wax, and a standard procedure for preparing samples is outlined.

F. E. A. T.

664. Natural Asphalts. E. G. Woodruff. *Oil & Gas J.*, 28.3.35, **33** (45), 32.—A survey is presented of the location and method of occurrence of the more important deposits of natural asphalts in the world. They are generally considered to be residues from asphalt base crude oils, the lighter fractions having escaped by natural distillation or filtration, but there is considerable evidence that the asphalt was formed in the strata, and never contained lighter oils, particularly in the case of limestone–asphalt formations. Asphalt seeps, in this case, do not therefore necessarily indicate the presence of an oilfield in the vicinity. Natural asphalt generally occurs on flat surfaces, but also oozes from canyon walls and steep slopes, or exists in vertical veins, and is seldom found in areas south of the equator.

Reference is made to the uses of natural asphalts in antiquity and to the modern uses of natural and refinery bitumens (at present in the U.S.A., 30% of the asphalt used is mined and 70% comes from the refineries). The advantages of the close control over the properties of refinery products, as compared with the natural products, are outlined. A list is given of the locations and types of natural asphalts found in the different countries in the world.

C. L. G.

665. Constitution of Asphaltic-Bitumen. F. J. Nellensteyn. *Asphalt u. Teer*, 1935, **35**, 200–203, 233–235, 281–283, 303–306.—A survey is given of various "organic" theories concerning asphaltic bitumen. Neither oxidation, polymerization nor dehydrogenation alone is sufficient to explain the phenomenon involved, but evidence is brought forward to support the theory that dissociation groups are formed (from the hydrocarbons) containing one or more C atoms (*e.g.* $\dot{:}CH$, $\dot{:}CH_2$). The oxidation of paraffinic hydrocarbons gives fatty acids containing one-half the number of C atoms as the original, but non-paraffinic hydrocarbons yield H_2O, CO_2 and CO. It is suggested that dissociation into a 1 C atom product precedes oxidation, and it is shown how carbon may be formed by oxidation of the dissociated radicals.

According to the colloidal theory, asphaltic bitumen consists of three groups—an oily medium, a lyophilic part protecting a lyophobic part (elementary carbon). The last two groups together form the asphaltic bitumen micelle. The stability of the mixture (and of asphaltic bitumen + solvents) is governed chiefly by the tension between the micelle and the medium. In general, substances causing the flocculation of asphaltic bitumen have lower surface tensions than the micelle. A distinction is made between separation due to flocculation and that due to "disintegration," the latter occurring with substances such as alcohol, acetone, etc., which are not completely miscible with the medium. In the latter case, a softer asphalt is formed. There is a critical surface tension for flocculation—the latter occurring with liquids which are miscible with the medium and protective body when the surface tension of the liquid at 25° is < 24–26 dyne/cm., whilst if the surface tension is > 26, solution occurs.

A study of the irreversible coagulation of asphaltic bitumen (*e.g.* by successive extractions with solvents of increasing surface tension) shows that the protective body and carbon are united by adsorptive forces, and it is suggested that it is the dissociation products that are adsorbed. (A parallel may exist between the adsorption of ions from hydrosols and of the dissociation products from organosols.) The nature of the micelle has been further examined in a number of ways, particularly by oxidizing asphaltenes with potassium permanganate. Among the conclusions, it is found that the "carbon" in asphaltic bitumen is partly present in cyclic form—

particularly in coal tar, but to a smaller degree in Trinidad asphalt. The degree of protection also varies considerably, Mexican asphalt being particularly strongly protected. C. C.

Class 600. Refining and Refineries.

666. Superheating and Foaming Phenomena in Dehydrating Emulsified Oils. G. Egloff and S. Berkman. *J. Phys. Chem.*, 1935, **39** (2), 265.—The phenomena accompanying dehydration of emulsified oils are priming and foaming resulting from superheating of the water present in the emulsion.

The conditions affecting these two phenomena are discussed.

Freedom from air is stated to produce a critical condition for delayed ebullition in liquids, whilst the absence of a free vapour space is stated to retard the separation of water from an emulsion on heating by preventing foaming. The foaming properties of emulsified crude oils are not additive. F. E. A. T.

667. Design of Fractionating Columns. II. G. G. Brown, M. Souders, H. V. Nyland and W. W. Hesler. *Ind. Eng. Chem.*, 1935, **27**, 383.—From the equations for material balance and equilibrium the following equation may be derived :—

$$\frac{y_{n+1} - y_1}{y_{n+1} - K_1 x_0} = \frac{A^{n+1} - A}{A^{n+1} - 1}.$$

y_{n+1} = concentration of any component entering rectifying section.
y_1 = concentration of same component rising from top plate.
x_0 = concentration of same component in liquid entering top plate.
K_1 = equilibrium constant for same component at temperature of top plate of section.
n = number of theoretical plates in the section.
A = $L/K_A V$.
K_A = average equilibrium constant in the section.
L = mols. of overflow.
V = mols. of vapour rising.

A similar equation may be derived for the stripping section.

These equations may be used for design. The steps taken to apply them are as follows.

(1) Estimate top and bottom temperatures of column from the compositions of distillate and residue.

(2) Estimate the feed plate temperature. This involves a certain amount of trial and error.

(3) Estimate concentrations of components on the feed plate. Equations are given for finding the concentration of those components appearing only in distillate or residue. Concentrations of two more components which appear in both distillate and residue may then be fixed from a knowledge of the temperature.

These three steps give sufficient data to solve the equation for n. This may be done rapidly by means of a graph.

The method is an approximation, but when tested against a series of columns which have been calculated by an accurate stepwise method it is shown to be reliable. One design calculation is given in detail as an illustration.

Test data were obtained from a commercial 48-plate gasoline stabilizer, and the plate efficiency was determined by applying the absorption factor equation. The column was provided with a side stream stripper, and the calculation was made for four sections.

It is pointed out that when applying the absorption factor method it is wise to calculate the first plate or two below the top plate and above the bottom plate by stepwise methods since the temperature variation over these plates is usually far from linear. The remainder of the column can then be calculated by the absorption factor method. P. D.

667a. Vapour Liquid Equilibrium Data for Commercially Important Systems of Organic Solvents. A. S. Brunjis and C. C. Furnas. *Ind. Eng. Chem.*, 1935, **27**, 396.—The binary mixtures examined were *n*-butanol–*n*-butyl acetate, and *n*-butanol–acetone.

The materials were carefully purified, the methods used being fully described. The estimation of vapour–liquid equilibrium was made in an Othmer apparatus.

n-Butanol–*n*-butyl acetate were found to form an azeotropic mixture with 72·9% *n*-butanol.

Specific gravity and refractive index data for the mixtures are also given. P. D.

668. Application of Graphical Method of Ponchon to Distillation and Extraction. E. W. Thiele. *Ind. Eng. Chem.*, 1935, **27**, 392.—The object of this paper is to make the method described by Ponchon (*Tech. moderne*, **13**, 20–24, 55–58 (1921)) available to American readers, and to extend it to solvent extraction.

The method is useful for the calculation of the fractionation of binary mixtures, and has the advantage that it does not assume a constant overflow down the column. In order to apply it total heat data are required for the binary mixture over the whole range of compositions, in the boiling liquid and saturated vapour states. It is pointed out that this data must be available if a good estimate of the reflux ratio throughout the column is to be made. The use of the method is illustrated.

The method is particularly useful when distillation is carried out in the critical region, since it is well known that the overflow varies greatly in this case.

The method of applying it to solvent extraction is described. It is pointed out that the resulting method is similar in some respects to that of Hunter and Nash, and Saal and Van Dyck, but is more convenient to use. The implications derived from a general consideration of the method as applied to solvent refining are discussed, including the cases of partially miscible, and immiscible solvents. P. D.

669. Auxiliary Strippers Give More Exact Stream Specifications. J. W. Thompson. *Nat. Petr. News*, 20.3.35, **27** (12), 21.—A modern tendency in refining developments is to provide facilities for closer fractionation. The article describes a new unit in which crude is flashed in a pipe still and passed to a 112-ft. column providing thirty-seven fractionating plates and eight trays for stripping the bottoms. A secondary column 53 ft. high is provided with twelve stripping plates and ten fractionating plates, and refractionates the overhead gasoline from the main tower. Special boiling-point naphthas and solvent gasoline are obtained here. It is claimed that by such an arrangement cuts can be made such that as little as 10° F. separates the F.B.P. of one fraction and the I.B.P. of the next. H. G.

670. Record Coking Run. F. H. Healy, C. H. Alberding and B. J. Flock. *Oil & Gas J.*, 21.3.35, **33** (44), 14; *Refiner*, 1935, **14**, 185.—A Dubbs two-coil selective cracking unit in Bradford, Pa., was recently shut down after a record run of 98 days. The shutdown was caused by a leak in a tube which had been in service for 3 years. Otherwise the run could have been continued, as the condition of the unit was excellent and no significant amount of coke was found.

This type of unit has two furnaces in which the light and heavy fractions of the charging stock and recycle stock are processed separately. Residue from the flash chamber is discharged into coking chambers made from disused treating towers used alternately. The total charge amounted to 133,646 brls. and the products obtained were :—

74·8% of 410° F. E.P. anti-knock gasoline.

8·2% of a very hard coke suitable for manufacture of carbon electrodes, 16·7% gas and loss.

Altogether 1949 tons of coke was produced. The run now in progress indicates that the result of the record run may be improved. The rate of throughput and the yield of gasoline have been increased, and the run has already been in progress for 40 days. R. A. E.

671. Hydrogenation Cracking of Rubber. C. M. Cawley and J. G. King. *J.S.C.I.*, 1935, **54**, 117T–123T.—This paper describes experiments made to produce motor spirit by hydrogenation cracking of rubber. The material used was a commercial crepe rubber, and the authors state that in order to be an economical proposition the rubber would require to be available at a much lower cost than that purchased in the normal market. The preliminary experiments were made in mild steel converters of 2 litres capacity, 150 gm. of rubber being treated at the reacting temperature for 2 hours with an initial hydrogen pressure of 120 atm. In some cases a molybdenum

catalyst was used. Details of the preparation of the latter are given, and the effect of varying the reaction temperature was also determined. The oils produced in the experiments employing the catalyst were almost colourless, and the yield of spirit to 200° C. increased as the reaction temperature rose. Little gas was formed at 375° C. or 400° C., but at 450° C. the gas represented about 20% of the rubber. The residues at 300° C. from the liquid products were clear oils, being of the consistency and appearance of lubricating oil in the case of the residue from the liquid produced at 375° C. The viscosities of the residue above 200° C. decreased with increasing reacting temperatures. The yield of spirit to 200° C. at 400° C. was approximately the same with and without catalyst, but whereas the former was stable and water-clear, the spirit produced without catalyst rapidly darkened and deposited gum. The fraction above 200° C. was found to dissolve rubber fairly readily, and a 50% rubber solution with 1·0% of sulphur was therefore employed with the supported catalyst in experiments in a continuous plant. The apparatus used is very briefly described. The operating conditions were as follows: Reaction vessel filled with 500 ml. catalyst, pressure 200 atm., temperature varied from 360° C. to 480° C. in different runs, input of hydrogen controlled by rate of residual gas of 5 cu. ft. per hour, throughput of rubber solution 220–250 ml. per hour. In starting an experiment, hydrogen was pumped in to a pressure of 200 atm., hydrogen and oil flow begun and catalyst bed gradually raised to reaction temperature. When conditions were steady the products were collected over periods of 12 hours. All of the spirits to 200° C. were stable and water-clear, and consisted largely of saturated hydrocarbons with small quantities of aromatics. The oils boiling above 200° C. were examined for suitability as lubricants. Full details of yields and analysis of the various products are tabulated. The authors conclude that rubber in the form of a 50% solution is amenable to treatment by hydrogenation cracking in a continuous plant at 200 atm. pressure of hydrogen at temperatures above 360° C. At 450–480° C. in the presence of the catalyst 40–60% of water-clear spirit which requires little refining is obtained, the yield of spirit decreases, while the yield of high-boiling oil increases with lower temperatures, and at 370° C. the spirit to 200° C. was 10·6% and the oil above 200° C., 87·6% of the rubber solution. The latter fraction gave 46·7% diesel oil, 21·5% lubricating oil and 19·4% of residue. A. O.

672. New Method for Refining Benzole and Hydrocarbons. C. A. Hahn and H. Nielson. *Gas J.*, 1935, **210**, 41–44.—Laboratory experiments are described in which the effect of a new reagent (not specified) for refining crude benzole has been investigated, and it is claimed that colour and gum-forming constituents can be readily removed without the high refinery losses associated with sulphuric acid treatment. The reagent particularly reacts with the unsaturated constituents, and also removes sulphur. The effect of the treatment on the iodine value, sulphur content and distillation of a benzole is given in curves and tables. Wijs reagent is considered to be unsuitable for the determination of iodine numbers because of its acidity, which prevents the estimation of hydrogen iodide formed by substitution. A neutral reagent (Mergen and Wenograduff, *Zeits. angew. Chem.*, 1914, **27**, 241) was preferred, which consisted of iodine and iodine trichloride dissolved in carbon tetrachloride. It was thus possible to titrate the hydrogen iodide formed after determining the excess iodine. The use of pyrogallol as a gum inhibitor is discussed, and it was found that benzoles containing this inhibitor darkened considerably on oxidation, and further that oxidized benzoles showed the same or sometimes less resinous gum than the same inhibitor-treated benzole evaporated in a pyrex dish, but not oxidized. The authors suggest that pyrogallol does not act as an inhibitor for the formation of gum. This view was strengthened by the observation that a deposit, similar to that obtained in the pyrex dish, invariably was found as a film on an inverted funnel (placed over the dish to improve the draught) when pyrogallol heated benzole was evaporated. It is concluded that resinous gums were formed in the inhibited benzole, but the inhibitor affected the boiling point of the resinous matter which became soluble in hot benzole vapour, the more so as the oxidation proceeded. W. A. W.

673. Refining of Low-Boiling Hydrocarbons by Condensation Processes. H. Brückner and G. Lang. *Brenn.-Chem.*, 1935, **16**, 126–128.—Using recovered benzole from active carbon and wash oil processes, and also a sample of cracked benzine, the relative refining action of anhydrous zinc, aluminium and iron chlorides as compared with

sulphuric acid has been traced. The various halide treatments were conducted with and without the application of heat. Ferric chloride may be used in methyl alcohol solution, which at saturation contains 85·54 gn. $FeCl_3$/100 ml.[3] solution, without detriment to the refining reaction. On the basis of resin formation test and refining loss values it is concluded that anhydrous ferric chloride is superior to sulphuric acid by reason of the non-removal of valuable olefines, leading to a stable product at a smaller treatment loss. B. C. A.

674. Hydrogenation of Coal. M. Pier. *Chem. Fabr.*, 1935, **8** (5/6), 45–54.—It is intended to increase the yield of Leuna benzine from brown coal to more than 300,000 tons a year until the end of the year 1935. The hydrogenation of coal has been tried with full success on the semi-commercial scale and with uninterrupted operation for three months. The warm mixture of coal (containing 2–5% ash) with heavy oil (1 : 1 by weight) passes at high pressure to a heat exchanger and a preheater, and is conducted into two vessels (each 12 m. length), where the temperature is regulated by introducing cold oil or H_2 to the mixture to maintain the temperature at about 460°. The catalyst is partly previously mixed with the mixture and partly added at different points. The liquid produced is fractionated, the heavy oil is separated and returned into the process. From the residual gas, the hydrocarbons are removed by washing and the gas so treated is returned to the process with H_2. The middle oil produced is hydrogenated in a second stage. The yield of benzine amounts to about 600 kg. per ton of coal. To avoid the corrosion of the tubes, they are coated with zinc, the pressure tubes being high-alloyed steel which resists the hydrogen under working conditions; steels with 3–6% Cr-content are specially adapted. Special arrangements are provided for de-ashing. The gaseous products contain about 60% by weight of methane and ethane and about 40% by weight of propane and butane. The latter may be used as liquefied (bottled) gas for domestic and other purposes. L. S.

675. Production of Hydrogen. B. Waeser. *Chem. Ztg.*, 1935, **59** (23), 233–235.—A discussion of the various processes now in use for producing hydrogen: by electrolysis, thermal conversion of acetylene, by the Fe-water vapour process, by partly liquefying water gas, by the water gas contact process, by liquefaction of coke oven gases, which (purified) contain 45–57% H_2 and 30–18% CH_4 and may be dissociated by the aid of water vapour + oxygen processes of the Ges. f. Koletechnik, Et. Kuhlman, Nitrogen Engineering Co., I.-G.-Farben. (oxygen process without supply of external heat and water vapour splitting process in tubes). L. S.

676. Activity of Bleaching Earth. H. Hofmann and K. Endell. *Ang. Chem.*, 1935, **48**, 187.—Dealing with the activation of bleaching earth, the authors show that by stepwise replacement of the Ca- and Mg-ions by H_2- and Al-ions the bleaching effect of pure bleaching earth is increased. The bleaching effect may therefore be determined by the amount of exchangeable-bound H_2- and Al-ions. L. S.

677. Solvent Extraction of Grabownica Residues. M. Godlewicz and K. Laidler. *Petr. Zeit.*, 10.4.35, **31** (15), 6–7.—The effect of solvent extraction of the residue from paraffin-free Grabownica crude oil was investigated, the following solvents being used: nitrobenzene, phenol, cresol, chlorex and furfurol. The results are tabulated. The viscosity, viscosity index, viscosity/gravity constant, set point and flash point are given for the initial material and the solvent blends. Oxidation tests according to specification D.T.D. 109 (Air Ministry) were carried out on the raffinates.

It is interesting to note that furfurol gives the greatest yield of raffinate, nitrobenzene gives the least yield, but the product has the highest viscosity index and the extracts have "positive viscosity indexes." It is concluded that phenol is the best solvent.

The raffinates require additional refining with acid or decolorizing earth to improve the colour. W. S. E. C.

678. Absorption of Gases in Spray Towers. A. W. Hixon and C. E. Scott. *Ind. Eng. Chem.*, 1935, **27**, 307.—Following a review of the publication of previous workers in this field, the authors describe in detail the apparatus and experimental method used in their determinations of over-all transfer coefficients. The over-all

coefficients for the absorption of ammonia and sulphur dioxide into a water spray as well as the absorption of benzene vapour from an air stream into an oil spray were determined for an inner "wall-free" section of a spray type absorption tower. The effect of variation in gas and liquid flow rates at several tower heights was determined for these three cases. A method was developed for the correlation of these effects into an empirical equation applicable over the ranges of conditions studied, and where possible these results were compared with previous, accepted data. The equation derived was of the form:

$$K_g a = \frac{C \times G^{0.8} \times L}{H^{0.5}}$$

where $K_g a$ = material absorbed, lb./min./cu. ft. of tower vol./mm. of partial pressure driving force;
C = a constant;
G, L = gas and liquid respectively, lb./ sq. ft./ min.;
H = height of tower, ft.

For ammonia C was found to be $2{\cdot}5 \times 10^{-5}$, for sulphur dioxide, $4{\cdot}4 \times 10^{-5}$, and for benzene, $0{\cdot}9 \times 10^{-6}$. E. N. H.

679. Carbon Black. E. Dittrich. *Brenn.-Chem.*, 1935, **16**, 121–125.—The preparation, employment, properties and testing of the various blacks are discussed in the light of existing information. Seventy-five references to the literature are appended. B. C. A.

680. Sweetening of Gasoline with Alcoholic Alkali and Sulphur. B. A. Stagner. *Ind. Eng. Chem.*, 1935, **27**, 275.—A method for sweetening both straight-run and cracked gasoline is described, in which a small previously determined proportion of elementary sulphur and a solution of caustic soda in methanol are used as the treating agent. No lead is required, as in the plumbite process, and the object of the alcohol is to bring the alkali into intimate contact with the gasoline. No emulsions are formed during treatment, the alcohol can be recovered and valuable by-products (sodium sulphide and thiosulphate) are formed. The sweetened gasoline is sufficiently colour stable for most purposes, but stability may be increased by acidifying or washing with dilute sulphuric acid. Instead of acid treatment, an acidic autoxidation catalyst can be used.

The process enables mercaptans to be removed by adding the requisite amount of elementary sulphur and anhydrous alcoholic alkali solution, or the removal of elementary sulphur may be effected by the addition of the requisite amount of mercaptan. Mercaptans are converted to disulphides and sulphur to alkali sulphide. The caustic alkali is converted first into polysulphides, and later, depending on conditions, into normal sulphide and thiosulphate. W. H. T.

681. Inhibitor Dyes in Cracked Gasoline. C. D. Lowry, G. Egloff, J. C. Morrell and C. G. Dryer. *Ind. Eng. Chem.*, 1935, **27**, 413.—The gum-inhibiting values of a number of azo dyes derived from intermediates of pronounced inhibiting effect have been tested, the results being expressed as "*cyclo*hexene numbers." The latter is defined as the increase in the induction period of *cyclo*hexene produced by the addition of 0·002% of an inhibitor (cf. Abs. No. 661). Each sample of dye was dissolved in benzene or hexane in order to facilitate its addition to the gasoline, these solvents having been found not to affect the induction period. It is shown that the azo group is detrimental to inhibiting action, and that a nitro group greatly reduces it. An added hydroxyl group, as in *p*- or *o*-hydroxyphenyl-azo-α-naphthol, increases inhibiting action and the addition of a methyl group in phenylazo-*o*-cresol gives a material of some slight effect. Indophenol and phenol-blue were found to be effective antioxidants, and the corresponding leucoindophenols were even more potent than the dyes themselves. It is pointed out that the effectiveness of the induline and nigrosine bases is probably due to the repeated diphenylamine groupings in their structures. Victoria blue B. base may owe its potency to the same groupings, or, if its structure is quinonidal, it would appear, like phenol-blue, to be an inhibitor of unusual type. The dye-inhibited gasoline loses its colour on exposure to oxidation, and it is therefore suggested that the colour imparted by the dye at any time after the beginning of storage would be a measure of its concentration, and its fading a warning of

inhibitor exhaustion. It is also pointed out that this effect would still be of value where both an inhibitor dye and a colourless inhibitor were used. From the depth of colour of the gasoline at any time after addition of the inhibitors, it should be possible to calculate the extent to which each substance had been oxidized.

W. H. T.

682. Refining, Testing and Utilization of Petroleum Oils. VII. Lubricating Oil Treatment. G. N. Critchley. *Fuel*, 1934, **14** (4), 98–106.—In continuation of previous articles written by the author (cf. Abstr. 553, 883, 1166, 1276, 1370 and 1511 of 1934) the treatment of lubricating oils to improve the colour, remove wax, reduce carbon or sludge formation and to increase the viscosity index is described in this article.

The colour of lubricating oils is due to fluorescence which is attributed to polycyclic aromatic hydrocarbons, *e.g.* chrysene and fluorene.

Dewaxing is effected by cold pressing, centrifuging and filtering in the presence of a filter aid or by the use of solvents, *e.g.* liquid propane at — 40° F.

Reduction of carbon and sludge formation is essential, since carbon causes pre-ignition and detonation with consequent loss of power in the engine; coke and sludge can be formed by slow oxidation of crank-case oil to form resins and asphaltenes, or by cracking of these compounds and of any resins originally present in the oil at relatively low temperatures.

The pros and cons of all the refining methods are discussed. Dewaxing causes a decrease in viscosity index, which tends to depreciate the oil and also reduces the quantity of true lubricant, *i.e.* "polar compounds."

The commercial methods employed include chemical methods—namely, treatment with sulphuric acid or caustic soda—and physical methods based on the adsorption capacity of the oil for bleaching clays such as Floridin, fuller's earth, charcoal, etc., and solvent extraction processes. A disadvantage in the use of clays is the loss of oil caused by its retention in the clay.

Solvents such as nitrobenzene, which dissolves naphthenic constituents, and propane, which dissolves only paraffinic constituents, β-β'-dichlorethyl ether and sulphur dioxide benzole mixture are used extensively. Solvent extraction methods are described and illustrated by means of triangular diagrams showing the relationship between viscosity/gravity constant and volume % of hydrocarbons present in the undissolved and dissolved layers respectively. These are applied to examples of single contact, multiple-contact and three-stage counter-current treatment.

W. S. E. C.

683. Preparation of Lubricating Oil from Californian Crude. J. C. Albright. *Nat. Petr. News*, 6.3.35, **27** (10), 25.—A description is given of a plant erected to produce a high-grade lubricating oil from the naphthenic-base Californian Crude. Research has classified the constituents of the crude as asphaltenes, carbogens, naphthenes, "parathenes" and paraffins. "Parathenes" is the name given to a class of bodies representing the best type of lubricant. They are believed to consist of naphthenic rings with paraffin side-chains. They have been found, it is claimed, to combine oiliness, flat viscosity-temperature curve, high flash point, low sludge-forming tendency and low carbon content. In its treatment the crude is topped, and the heavy residuum is flashed in a vacuum tube unit at a temperature of 725° F. and passed to the fractionating columns. Here four side cuts are taken to provide the lubricating oil distillate. This distillate is first freed from asphalt by diluting with 2·5 parts of propane. After settling, the solution is cooled to — 45° F. and the precipitated wax filtered off. The propane is recovered and the residue is treated with 2 parts SO_2 in an Edeleanu unit at 135° F. The raffinate is again extracted with a mixture of SO_2 and benzene in proportions sufficient to produce 50% of second stage raffinate. A final treatment with decolorising clay at 350–450° F. and filtration yields the finished product.

H. G.

684. Production of Cylinder Oils in the Polmin Refinery. Z. Z. Biluchowski and W. Filepowicz. *Przem. Chem.*, 1934, **10–12**, 313–317.—An excellent base for the production of cylinder oils has been obtained when working up paraffin and non-paraffin material using tall dephlegmators with high vacuum distillation. The results of working up the base into cylinder oils, using saturated and superheated steam, have been determined in the laboratory and in the refinery.

E. F.

685. Refining Motor Oils by the AlChlor Process. A. McAfee. *Chem. Met. Eng.*, 1935, **42**, 136–138.—After shortly discussing the qualities of an ideal motor oil the author sketches the work carried out at the Port Arthur refinery of the Gulf Refining Co. during the last fifteen years, which has cumulated in the production of 75,000 lb. aluminium chloride per day, at a cost such that it may be sold at 5 cents per lb.

G. R. N.

686. Chemical Fire-Extinguishers. E. Boye. *Chem. Ztg.*, 1935, **59** (15), 155–157, (17) 175–177.—Chemical fire-extinguishers are to be classified as dry, fluid and foam types, the latter being of special interest. The one group contains the gas- and foam-producing chemicals in solution, the other, one or both constituents powdered, either separated one from another or combined. The author gives particulars relating to the extinguishing of burning benzine, benzole, ether, etc. (87 references, chiefly patent numbers). L. S.

687. Use of New Metals in the Petroleum Industry. *Oil & Gas J.*, 28.2.35, **33** (41), 27.—Summaries are given of papers presented at the annual meeting of the American Institute of Mining and Metallurgical Engineers, jointly with the Institute of Metals, Iron and Steel and Petroleum Divisions.

Alloy castings for use in Petroleum Industry, by W. F. Furman.—Analyses and investigations of service given by alloy castings of metals containing Cr and/or Ni of special interest to the petroleum industry are outlined. From the experience of several producers the following figures may be taken as safe load limits for 24/26Cr–10/12Ni alloys at 1500° F., 1600° F., 1800° F. and 2000° F., 2430; 1440; 475 and 100 lb. per sq. in., respectively. Higher figures than these have been in use for years with lower strength alloys than these, but even with the above alloys a large safety factor should be used.

Further research, duplicating actual working conditions, appears to be essential. Recommendations, based on producers' experience, are given for the most economical alloy which can be used with safety under different temperature conditions and under (*a*) low sulphur and (*b*) high sulphur conditions.

Metallurgical aspects of producing equipment, by A. G. Zima.—The mechanical properties of the alloy steels used in various parts of oil-production equipment are tabulated and discussed, and the desirable characteristics of drilling tools outlined. Alloy cast irons are now being used intensively by manufacturers of pumps, compressors, valves, oil and gas engines, etc., where high tensile properties are necessary in castings that are readily machined. Centrifugally cast alloy cast-iron cylinder liners are now being used in slush pumps and diesel engines.

Corrosion tests in refinery services, by J. E. Pollock, E. Camp and W. R. Hicks.—The results of corrosion tests on strips of a large number of different metals and alloys (compositions given) under conditions duplicating as far as possible refinery service are given. It is concluded that high Cr–Ni steels are highly resistant to corrosion in the relatively mild conditions of fresh water and steam service (practically oxygen-free fresh water containing a layer of oil). The oil layer offers a simple means of excluding air and thus minimizing corrosion. Steam valves appear to suffer more from erosion than corrosion, except when O_2 and CO_2 are present. The Cr–Ni steels containing $> 25\%$ Cr are highly resistant, particularly when the carbon content is low.

Material used in refinery pumps, by A. C. Harnsberger.—The availability, manufacture and suitability of different metals in refinery pumps under varied conditions of pressure, temperatures and corrosive conditions are discussed. It is concluded that rolled and forged products are thoroughly reliable and economic for a wide variety of uses, whilst research in the manufacture of alloy castings has led to greatly improved products. In general, the high Cr and Cr–Ni steels have poorer castability than carbon steel. 5% Cr steels containing Mo or Wo provide useful service, but are difficult to handle in the foundry, and have a greater tendency to crack than the 13% Cr steels, whilst having a narrower range of fluidity, and must be more carefully watched to obviate porosity in castings, particularly when the C content is low. 18·8 Cr–Ni steels used in pump manufacture have excellent fluidity, only a slight tendency to crack in the mould, and good welding properties. Cr and Cr–Ni steel castings are more easily cut by oxy-acetylene flames and cold saws than carbon castings. Recommendations for the minimum dimensions for metal sections and air

passages in pumps are given. The 8–18 Cr–Ni alloys were rated the same as the high carbon 18–8 alloys, whilst the high Ni, low Cr (*e.g.* 58·6 Ni, 11·44 Cr), were less resistant than the KA_2 metal. The high, medium and 12–14 Cr steels were less resistant than the KA_2S, the effect being proportional to the Cr content. In general low Cr alloys left much to be desired, although they were superior to steel, particularly in the presence of oxygen, as in crude oil storage. For such services, however, better results at comparative cost were given by galvanized stocks and aluminium. The extra cost of the more resistant high Cr–Ni alloys, KA_2S, KA_2 and high Cr steels is generally justifiable only for small articles under fairly corrosive conditions. In debutanizer service alloy cast iron gave better results than the Cr steels and Cu–Ni alloys.

Use of condensers and heat exchangers, by H. L. Bedell.—Experience with a wide variety of metals in heat-exchanger and condenser service has indicated that admiralty metal has given excellent service, particularly in the presence of alkalis to neutralize any acid bodies in the oil, and when the zinc content is low. Pure Cu and Cu tubes containing a small amount of As or Si are also coming into use, preferably under conditions of temperature below 300° F. From observations made under one set of conditions, the materials were placed in the following order of services: (1) Cu–Ni and Cu–Ni–Al. (2) Cu and Cu–As or Cu–Si. (3) Cu–Zn–Sn. (4) 4–6 Cr Steel and (5) plain C steel.

Welded pressure vessels in petroleum refineries, by R. K. Hopkins.—A discussion is presented of the metals used for pressure equipment under widely differing conditions. For low-temperature work, ordinary carbon steel has too low and erratic an impact resistance at — 50° F. to 75° F., an alloy steel being preferred (*e.g.* 2¼% Ni steel). The heat treatment given to welded pressure vessels before dispatch consists primarily, in the case of plain carbon and the lower alloy steels, of a stress relief at 1150° F. for 1 hour per inch of thickness, the vessel being then furnace-cooled. Fusion welded vessels can be constructed from seamless rolled sections with a wall thickness of up to 4⅛ in.

Economical selection of sucker rods, by B. B. Westcott and C. N. Bowles.—The operations and conditions in wells are discussed with reference to the selection of sucker rods based on data presented on the chemical composition, cost and physical properties of thirteen types of sucker rod materials under (*a*) non-corrosive, (*b*) corrosive, non-sulphide, and (*c*) corrosive sulphide conditions. C. L. G.

688. Non-Corrosive and Heat-resistant Types of Iron and Steel. A. Lissner. *Petr. Z.*, 10.4.35, **31** (15), 17–22.—The chief steels used for plants working at high temperatures are ferritic and semi-ferritic steels, martensitic chromium steels, austenitic chromium–nickel steels sometimes admixed with copper, molybdenum and wolfram, alloys which are low in iron content but with high contents of nickel, chromium, cobalt, etc., silicon-cast iron and austenitic cast iron, *e.g.* Monel cast iron.

These are reviewed and the various advantages of particular types described. The resistance to corrosion of most steels is produced by the addition of at least 13% of chromium, thereby rendering the iron passive. The best steels should still have a creep stress of 8–12 kgm./sq. mm. at a temperature of 600° C.

Austenitic steels, *e.g.* V2A staybrite, etc., consist of mixed crystals which must not be subjected to temperatures which can destroy the solid solution; a temperature range of 600–900° C. should be avoided, because a layer of chromium carbide separates at these temperatures. Most austenitic steels which contain minimum quantities of carbon are improved by adding small quantities of vanadium, titanium, tantalum, niobium, zirconium, etc., which form a protective heat-resistant layer. All austenitic steels are electrically resistant at high temperatures.

Martensitic steels do not rust, but they are useless from the point of view of maintaining their hardness with sudden cooling. These steels are used chiefly for turbine paddles.

Various graphs and tables are given showing the relationship between creep stress expressed in kgm./mm.^{2} and stability and temperature for the steels described. Photomicrographs are given showing the corrosive effects. W. S. E. C.

689. Special Steels for Hydrogenation and Refining Plants. A. Fry. *Petr. Zeit.*, 3.4.34, **31** (14), 15.—Ordinary steels are corroded under the influence of water at pressures greater than 200 atmospheres and at a temperature of 600° C. The addition of small quantities of molybdenum, chromium, silicon or aluminium to steels used for

boilers causes greater stability and resistance to corrosion under conditions of high temperatures and pressures. These modified steels are applied in the production of ammonia from atmospheric nitrogen and in the hydrogenation of coal to produce benzine and oil. W. S. E. C.

690. Inspection of Oil-Refinery Equipment. F. L. Newcomb. *Refiner*, 1935, **14**, 158–162.—Inspection methods for cylindrical or spherical vessels include visual examination, sounding or hammer tests and thickness determinations. The latter are necessary for the computation of the safe allowable operating pressure. New or extensively repaired vessels should be subjected to a pressure test using a non-expandable medium up to a stress equal to 1½ times the maximum allowable working stress. For routine inspection a pressure test with steam or inert gas at a somewhat lower pressure than the normal operating pressure serves for the detection of openings or untightened joints. B. C. A.

691. Calorized Refinery Pipe Still Tubes. C. L. Clark, R. S. Brown and A. E. White. *Oil & Gas J.*, 28.3.35, **33** (45), 44.—The lack of corrosion and oxidation resistance of the low-alloyed pearlitic type steels of the necessary creep strength at high temperature, and the initial expense and limited serviceability of the corrosion-resisting high alloy type steels have led to the further development of the calorizing process by which a highly resistant coating can be applied to the former type of steel. The new method of calorizing consists of (*a*) heating the metal in a closed retort with the calorizing mixture (containing aluminium), which forms a brittle coating of Fe–Al alloy (50–75% Al) to a depth of 0·005/0·010 in., and (*b*) heat treatment which causes the alloy to penetrate into the steel to a depth of about 0·040 in., thus reducing the Al content of the surface layer to about 30%. The metal so treated possesses adequate ductility, but will crack under excessive deformation. It is necessary therefore to choose the base material of sufficient strength, the calorization providing the corrosion resistance.

A series of investigations of the properties of various low-alloyed steels treated by this process has been undertaken, and from the data on these provided, it is shown that calorization increased the load-carrying ability in all cases. This is largely attributed to the increased oxidation resistance, rather than to any increase in the strength of the calorized specimen. It was found that 5–6% deformation is required to produce cracking in the calorized layer. The ductility is slightly lowered by the calorizing process, but not sufficiently to cause brittleness. Hardness tests (Bierbaum scratch test) on different positions in the calorized coating and in the metal itself demonstrated the superior hardness of the coating over the base metal, this hardness diminishing through the depth of the coating. None of the calorized specimens tested was attacked by oxidation at 1200–1800° F. or by H_2S at 1200° F. The hardness of the coating also protects the metal from erosion during tube cleaning. From a consideration of the application of creep stress data to the design of cracking still tubes, using the Barlow formula $\left(\frac{\text{O.D. tube} \times \text{pres. sq. in.}}{2} = \text{tube wall stress}\right)$ the use of calorized tubes of D.M. or 1·0 Mo is recommended for high-temperature work, particularly under abnormal conditions. In refinery practice such metals have provided long life with reduced maintenance cost, and allowed the use of high temperatures and pressure, which were before considered impossible except with the very expensive 18–8 Cr–Ni alloy. C. L. G.

692. Instruments in Control of Refinery Processes. N. Williams. *Oil & Gas J.*, 28.3.35, **33** (45), 50.—The importance of the provision, proper installation and maintenance of adequate instrument control facilities in modern refinery operations is discussed. It is suggested that the service of trained instrument men is essential, particularly for the newer and more complicated instruments. The life of an instrument depends on: (1) the age of the instrument in relation to the stage of development of the particular process for which it is used; (2) the type of the instrument, *e.g.* the simpler indicators wear out less rapidly than control or recording instruments of more complicated type and involved with moving parts; (3) the amount of usage placed on the instrument; (4) the extent of maintenance and careful checking of the instrument and (5) proper initial installation, *i.e.* protection from the elements, vibration, shock, etc.

It is conservatively estimated that the average life of a refinery instrument is 7 years, but with modern improvements in the design and ruggedness of instruments they should last much longer. On the basis of a 10-year life, a single point recording pyrometer probably costs less than 24 cents a day.

Factors to be considered in the proper installation of instruments include :—protection from weather, minimization of vibration and shock, convenience of location and centralization of instruments and control, accessibility of instruments and leads for servicing, substantiality of installation and general appearance of instrument panel board and layout. C. L. G.

693. Patents on Plant. N. Wilson. E.P. 425,610, 13.3.35. An oil burner assembly in which the oil to be vaporized is fed by gravity from a tank above the burner and is introduced at the lower part of a vaporizing chamber. The pressure generated within the chamber keeps it substantially empty, so that incoming oil is brought immediately into contact with the heated base of the chamber and quickly vaporized.

O. C. Brun. E.P. 425,707, 20.3.35. A heat-meter for measuring the consumption of heat by the evaporation of a liquid in a vessel having a vapour discharge orifice. The vessel contains means which, by capillary action, maintain the liquid surface from which the evaporation is effected at a predetermined level independent of the level of the liquid in the vessel.

A. E. Ridley. E.P. 426,161, 28.3.35. Apparatus for the removal and recovery of oils and grease from oil-laden water.

P. Granichstaedten. E.P. 426,491, 4.4.35. Means for increasing calorific efficiency by supplying a mixture of producer gas rich in hydrogen and heavy oil, to an internal combustion engine.

H. S. Sayles and I.C.I. E.P. 426,560, 3.4.35. Apparatus for treating gases with liquids.

G. Potts. U.S.P. 1,993,283, 5.3.35. A furnace provided with means for protecting the upper tubes in the convection section from radiant heat. A shield is arranged between each of the upper tubes and the adjacent radiant surface in the convection section. Heat insulating material is supported on each of the shielding elements.

L. C. Huff. U.S.P. 1,993,446, 5.3.35. A multi-stage, continuous, vertical apparatus for the treatment of distillates. A whirling motion is imparted to the reacting liquids in each stage, the treating agent being withdrawn in a tangential direction and returned at a lower adjacent level.

H. P. Benner. U.S.P. 1,993,500, 5.3.35. A protective lining for reaction vessels, etc., which is spaced from the inner walls of the vessel by suitable distance pieces. A carbonaceous insulating material protects the walls from excessive temperature.

R. E. Nagel. U.S.P. 1,994,252, 12.3.35. Automatic liquid level control for reaction chambers.

W. B. Mathews. U.S.P. 1,994,365, 12.3.35. Operating mechanism for flue dampers.

R. K. Hopkins. U.S.P. 1,994,649, 19.3.35. A pipe coil for cracking plants, the inner surface of which is coated with a corrosion-resistant vitreous enamel having a smooth, glass-like finish.

W. H. Bahlke and T. E. Stockdale. U.S.P. 1,997,675, 16.4.35. A distillation apparatus for lubricating oil, in which the charge is mixed with a non-volatile liquid and heated in a pipe still. The non-volatile liquid stores enough heat to effect vaporization of a given fraction of the charge when it is introduced into a flash chamber.

G. S. Dunham. U.S.P. 1,998,122, 16.4.35. Apparatus for handling and discharging residual oil produced in cracking operations. W. H. T.

I.G. Farbenind. A.-G. D.R.P. 601,641, 3.12.31. Regulating means for direct-current generators for conversion of hydrocarbons in an electric arc.

G. Neumann. D.R.P. 602,280, 7.9.34. A filter for simultaneously but separately filtering two different hot gases.

A. Schmalenbach. D.R.P. 605,833, 23.12.24. Low- and high-boiling fractions are recovered from a distillate mixture by continuous vacuum distillation, so that the higher-boiling constituents separated at the second phase are condensed and conducted to the bottom of a distillation unit. The lower-boiling constituents are passed to a rectifying unit where a relatively low vacuum is maintained.

G. Wobsa. D.R.P. 606,133, 8.7.28. Apparatus for fractional distillation in which each cut is removed by the vapours generated in the next stage. If the heat content of the fraction is insufficient, additional heat is added.

Siemens–Lurgi–Cottrell Electrofilter Ges. D.R.P. 606,334, 23.6.32. Apparatus for cleaning the precipitation-surfaces of electrical gas purifiers.

Ruhrchemie A.-G. D.R.P. 606,771, 11.12.30. A two-stage heat-exchanger, the attached reaction-zones being constructed of refractory ceramic material.

K. Schmidt. D.R.P. 607,738. A tank car provided with means for the removal of sludge.

I.G. Farbenind. A.-G. D.R.P. 608,037, 14.1.35. A fire-extinguisher containing inorganic porous active masses (active carbon) impregnated with carbon tetrachloride.

Drucktransformatoren Ges. D.R.P. 608,252, 28.5.33. A heating medium for high temperatures, consisting of over 50% of zinc chloride with alkali halogenides forming double salts (*e.g.* $75ZnCl_2 + 15KCl + 10NaCl$).

Bat. Petm. Mij. D.R.P. 608,253, 14.1.31. High vacuum distillation apparatus, the column plates being spaced from one another so that the distance corresponds to the "free way-length" of the molecules at the operating pressure. The evaporation surfaces are vertical, with double-side effect, and the condensing surfaces are horizontal both in the direction of suction and oppositely.

Druckstransformatoren Ges. D.R.P. 608,364, 4.1.29. A heat-exchanger for transferring the heat of gases to a closed fluid-circuit. The fluid is zinc chloride ammoniate or di-ammoniate.

Electrometall. D.R.P. 608,543, 19.1.34. A filter comprising parallel rotatable filter bodies each consisting of slotted or perforated discs arranged on a shaft one above the other. The discs of each body project into the spaces between the discs of the adjacent body.

Soc. Chilowsky. D.R.P. 608,553, 3.9.32. Apparatus for the production of oil-gas.

A. Klönne. D.R.P. 610,357, 14.10.32. Means for dehydrating tar for waterless gas holders.

J. F. Stallard. Austr. P., 136,384, 6.11.30. Apparatus for refining oil in which the reagent is removed from the lower part of the washer by means of a circulating pump and sprayed uniformly over the surface of the quiescent oil.

A. Teich. Austr. P., 140,746, 26.5.33. A dephegmator with specially designed hollow cooling bottoms.

H. Busch. Austr. P. 140,940, 15.5.34. A closure arrangement for filter presses.

L. S.

694. Patents on Cracking. T. O. Wilton. E.P. 424,645, 26.2.35. A process for the dehydration, distillation or cracking of tar, etc., in which the charge is mixed with hot recycle oil in order to effect dehydration and preliminary distillation of the tar.

Stand. Oil Co. E.P. 425,726, 20.3.35. Heavy residue and intermediate oil are cracked separately, and the hot products from the former used to preheat the charging stock by direct contact. The heavy residue produced from the charge stock is brought into direct contact with the cracked products from the intermediate oil.

Nieuwe Octrooi Mij. E.P. 425,874, 22.3.35. Oil is vaporized, the vapours are mixed with inert gas and the mixture is passed through a conversion zone at above 900° F. at a high velocity so that carbon deposition is reduced to a minimum. The vapours are passed to a reaction zone and then condensed in order to produce motor fuel.

Nieuwe Octrooi Mij. E.P. 425,953, 25.3.35. Simultaneous cracking of naphtha and gas-oil in the vapour phase with the aid of a heated, heat-carrier gas.

Houdry Process Corpn. E.P. 426,642, 8.4.35. An improved reaction chamber for the heat treatment of gas or vapours in the presence of contact material.

O. J. Nelson. U.S.P. 1,993,017, 5.3.35. A process for the cracking of heavy, sulphurous, asphaltic oil containing water, into hydrocarbon vapours and coke. The charge is injected into the bottom of a column of heated, fused sulphur-absorbing material, the vapours are condensed, and the coke floating on the column is collected and removed.

J. C. Morrell. U.S.P. 1,993,520, 5.3.35. Conversion of tar acids by heat treatment at 850–900° F. and 50 to 250 lb. per sq. in. in the presence of water or steam. The motor-fuel product is subjected to the combined action of a reducing agent and a reducing catalyst at 650–850° F.

H. L. Pelzer. U.S.P. 1,993,894, 12.3.35. A combined mixed-phase, high-pressure: vapour-phase, low pressure, and direct coking process in which the formation of incondensable gas and of coke is reduced to a minimum.

R. Wietzel and B. Engel. U.S.P. 1,994,058, 12.3.35. Cracking stock is mixed with an organic emulsifying and wetting agent capable of reducing the surface tension of the cracked products. The addition facilitates the separation of the oil from pasty products obtained by low-temperature carbonization, from carbonaceous material resulting from extraction processes and from coke and ash, etc.

W. S. Gullette. U.S.P. 1,994,246, 12.3.35. Heavy oil is cracked in the vapour phase, and the reflux condensate from the fractionation of the cracked product is recracked in the vapour phase at a higher temperature. Neither the unvaporized residue from each of the stages nor the reflux condensate from the second stage is recycled.

J. C. Morrell and C. H. Angell. U.S.P. 1,995,005, 19.3.35. This refers to an improved process for the reduction of the non-vaporized products of cracking to coke in a reduced pressure zone outside of the main cracking zone and simultaneously reforming gasoline or pressure distillate. This procedure gives non-residuum operation and permits the lengthening of the operating cycle.

R. E. Wilson. U.S.P. 1,996,091, 2.4.35. Heavy distillates are cracked under pressure at above 850° F. until conversion into gasoline exceeds 12% of the charge. A special type of furnace and cracking oil is used, and the application of heat is controlled so that the wall temperature of the coil does not exceed 20° F. above that of the maximum temperature of the oil.

J. B. Heid. U.S.P. 1,996,243, 2.4.35. Conversion of oil in the presence of hot gaseous products of combustion.

C. C. Towne. U.S.P. 1,997,159, 9.4.35. Reforming gasoline and naphtha in the presence of selenium as catalyst. The latter is maintained, in a molten condition, at the bottom of a reaction chamber, the conditions of conversion being 400–600° C. and a pressure in excess of 300 lb. per sq. in.

G. S. Dunham. U.S.P. 1,998,123, 16.4.35. Apparatus for the topping of crude oil followed by liquid phase cracking of a selected portion of the remaining heavier oil. A method of control is provided whereby the various phases may be kept in step with one another.

N. E. Loomis. U.S.P. 1,998,248, 16.4.35. Oil is cracked and passed to a soaking drum. Cracked products are withdrawn and cooled by injection of cold oil into the stream of hot cracked material.

A. C. Spencer. U.S.P. 1,998,402, 16.4.35. A tube and drum type of cracking apparatus.

W. M. Cross. U.S.P. 1,998,571, 23.4.35. A cracking plant with means for avoiding the deposition of carbon. The hot cracked products are cooled by admixture with a cooling medium having a relatively high latent heat of vaporization. This serves to retard the evolution of vapours in the vaporization zone and to produce a residue which may be utilized as fuel oil. W. H. T.

I.G. Farbenind. A.-G. D.R.P. 602,444, 22.1.31. Silica-containing materials are used for the construction of apparatus for the thermal treatment of hydrocarbons, whereby carbon formation is minimized and sulphur compounds have no noxious effect.

Deutsche Hydrierwerke. D.R.P. 611,922, 3.6.32. Cracking in the presence of liquid catalysts—*i.e.* molybdenum sulphide dissolved in *cyclo*hexane.

Chilowsky. D.R.P. 608,603, 28.3.31. Production of oil-gas by partial combustion of atomized heavy oil in a specially designed apparatus. L. S.

695. Patents on Hydrogenation. Int. Hydn. Patents Co. E.P. 424,748, 27.2.35. Hydrogenation of hydrocarbons containing unsaturated compounds at below 300° C. in the presence of catalysts comprising a sulphide of iron, zinc, manganese, copper, or tin. Only the easily resinifying compounds containing more than one double bond or compounds containing acetylenic bonds are hydrogenated, the aromatics and mono-olefines being unaffected.

I.C.I. E.P. 425,679, 19.3.35. Hydrogenation of coal, in the form of a paste or suspension in oil, under such conditions that the maximum proportion of volatile heavy oil is formed. The heavy oil is subjected to destructive hydrogenation for the production of light oils and middle oils, and the latter further hydrogenated to produce benzine.

M. Pier. U.S.P. 1,993,226, 5.3.35. Production of hydrocarbons of low boiling

point from liquid carbonaceous materials containing asphalt, by hydrogenation. Prior to treatment, the asphaltic material is precipitated by the addition of paraffin wax.

K. Schoenemann. U.S.P. 1,993,386, 5.3.35. A pretreatment intended for asphaltic hydrogenation or cracking stock. Asphaltic and resinous materials are removed by adding to the stock an asphalt precipitating solvent and an electrolyte capable of coagulating these materials.

C. Krauch and M. Pier. U.S.P. 1,994,075, 12.3.35. Hydrogenation of solid and liquid fuels at 300–700° C. and at least 20 atm. pressure in the presence of a catalyst. The latter contains a heavy metal sulphide associated with free heavy metals, the oxides of which are difficultly reducible.

R. H. Griffith. U.S.P. 1,994,277, 12.3.35. Hydrogenation of high boiling-point hydrocarbons at 440° C. and 110–200 atm. pressure in the presence of a molybdenum catalyst and a promotor (Si, Li, Bo, P, or Ca), together with a substance yielding hydrogen sulphide under the conditions of the reaction.

R. C. Cook. U.S.P. 1,994,982, 19.3.35. Production of low-boiling hydrocarbon distillates from hydrocarbon gas and unvaporized cracked residuum. The gas is heated in order to increase its hydrogen content and to maintain the residue at hydrogenating temperature, and is then contacted with the residue at above 1000 lb. per sq. in., thereby hydrogenating the residue.

G. H. B. Davis. U.S.P. 1,995,604, 26.3.35. Multi-stage hydrogenation of heavy oil in the presence of a sulphactive catalyst, each stage being controlled in order to avoid both coke formation and saturation of the hydrocarbons, and to obtain motor fuels of substantially the same anti-knock value.

C. Krauch and M. Pier. U.S.P. 1,996,009, 26.3.35. Destructive hydrogenation at 300–700° C. and 20 atm. pressure of solid and liquid fuels in the presence of an oxide of a metal of the fourth group of the periodic system.

H. I. Waterman. U.S.P. 1,998,212, 16.4.35. Solid fuels are liquefied by adsorbing Prussian-blue from a colloidal solution on to the fuel, followed by hydrogenation. W. H. T.

I.G. Farbenind. A.-G. D.R.P. 608,466, 15.2.25. Hydrogenation of solid fuels at elevated temperatures and pressures in the presence of molybdenum. L. S.

696. Patents on Crude Oil. A. W. Burwell. U.S.P. 1,993,646, 5.3.35. Water-in-oil emulsions are resolved by the addition of a mixture of saponifiable acidic oxidation products prepared from mineral oils.

M. de Groote. U.S.P. 1,994,758, 19.3.35. A process for breaking petroleum emulsions which consists in subjecting the emulsion to the demulsifying action of a sulphonated dipolymer. W. H. T.

697. Patents on Gas. G. F. Horsley and I.C.I. E.P. 424,843, 1.3.35. Ethylene and its homologues are separated from gas mixtures by treatment with a solution containing ammoniacal cuprous nitrate, salicylate, phenolate or cresolate. The dissolved gases are recovered by heating and/or reduction of pressure.

A. Cambron and C. H. Bayley. E.P. 425,606, 11.3.35. Thermal treatment of hydrocarbon gases in a heated reaction zone. The velocity of the gas is repeatedly varied at successive unobstructed annular spaces adjacent to the heated wall of the reaction zone, the arrangement being such as to permit of unobstructed flow along the wall.

H. Baker. E.P. 426,153, 28.3.35. Sulphur compounds present in coal-gas by-products are decomposed by means of hydrogen. W. H. T.

Co. Prod. Chim. Electromet. D.R.P. 593,669, 20.12.31. Ethylene is produced by reducing acetylene with a cold, nearly neutral or slightly acid aqueous solution of a chromic salt. The solution is then acidified and electrolyzed.

I.G. Farbenind. A.-G. D.R.P. 595,463, 14.2.32. Acetylene is produced from hydrocarbon gases by means of the electric arc, in various stages of increasing energy.

J. Becker. D.R.P. 604,772, 6.11.31. Coke oven gases are desulphurized by soda solution which is reactivated by aeration. The gases resulting from the reactivation are preheated to prevent separation of water and then burned under a furnace.

Gastechnik. D.R.P. 607,819, 24.10.33. Gas desulphurization is effected in towers filled with moulded purification masses which are arranged to be regenerated in sections.

E. Huttemann and W. Czernin. D.R.P. 607,930, 25.2.33. Adsorption of gases by means of hydrosilicates, aluminates and ferrites.

E. Haber. D.R.P. 607,963, 20.6.31. Apparatus for the separation of solids or fluids from gases.

C. Otto & Co. D.R.P. 608,044, 20.6.33. Plant for the production of carburetted water gas.

Carbo-Norit Union. D.R.P. 608,464, 12.12.29. The heat of waste gases derived from absorption processes is recovered by means of an arrangement of heat-accumulating masses before and after the absorbers.

Barmag-Meguin. D.R.P. 608,554, 21.3.34. A gas-washing plant comprising a plurality of chambers arranged one above the other. Each chamber is connected to a reservoir for the washing liquid which is removed by the pressure of gas.

Aktis. Austr. P. 141,202, 28.12.27. Hydrocarbon gases are produced by the action of a high frequency electric field on a mixture of water and coal impregnated with solutions of metallic salts which combine with sulphur. L. S.

M. P. Youker. U.S.P. Re. 19,500, 12.3.35. A process for the conversion of hydrocarbon gas into comparatively non-volatile liquid. The gas is compressed in excess of 500 lb. per sq. in. and heat treated at 750° F. for sufficient time to convert a portion of the gas into liquid hydrocarbons. The products are separated into gas, gasoline and a liquid lighter than the gasoline. The gas and gasoline are removed from the process, and the light liquid is returned to the process in admixture with fresh gas.

G. Egloff. U.S.P. 1,993,503, 5.3.35. Production of liquid solvents or anti-knock compounds by cracking normally incondensible hydrocarbon gases in the presence of steam and hydrogen pre-activated by electrical discharge. The gases are then subjected to a stabilizing action at an increased pressure in the presence of a catalyst.

V. Ipatieff. U.S.P. 1,993,512–3, 5.3.35. Conversion of normally gaseous olefines into motor spirit by pyrolysis in the presence of a catalyst. The latter may be phosphoric acid with a chloride of the alkaline earth metals, or a calcined mixture of a phosphoric acid and a solid adsorbent.

M. Hofsasz. U.S.P. 1,997,144, 9.4.35. Pyrolysis of ethylene into benzine-like material by heat treatment (300–500° C.) under pressure in the presence of an inert liquid medium.

H. Birkbeck. E.P. 426,496, 4.4.35. A continuous process for generating fixed gas from oil. W. H. T.

698. Patents on Motor Spirit. B. A. Stagner. E.P. 425,623, 19.3.35. Refining of gasoline, in which prior to treatment with a concentrated alkali, the proportions of elementary sulphur and mercaptans are so adjusted that after treatment none of these materials is left in the gasoline.

W. D. Triggs. E.P. 425,938, 25.3.35. Removal of carbon disulphide, etc., from motor benzole, cracked benzine, etc., by treatment with aqueous alkaline solutions under high pressures and temperatures.

A. Coredo. E.P. 426,478, 2.4.35. A motor fuel comprising 10% of water, 40% of benzole and at least 30% of raw spirit. Part of the benzole may be replaced by wood spirit oil and the fuel may also contain fusel oils.

W. G. Hamilton, R. G. Follis and H. P. McCormick. U.S.P. 1,993,140, 5.3.35. Removal of hydrogen sulphide by treatment with a dilute aqueous solution of sulphur dioxide. The aqueous solution is separated and added to plumbite-treated hydrocarbon oil, in order to precipitate sulphur compounds resulting from the plumbite treatment.

W. W. Gary. U.S.P. 1,994,511, 19.3.35. Treatment of petroleum by contact with fluid sulphuric anhydride, while the temperature at the point of contact is sufficiently low to change the state of the sulphuric anhydride. The contacting sulphuric anhydride is insulated against the effect of the low petroleum temperature.

R. B. Thacker. U.S.P. 1,994,969, 19.3.35. Gasoline is sweetened with an aqueous solution of sodium plumbite, the latter is separated and not more than 0·006% of elemental sulphur is added to the treated fuel. The latter is maintained in a quiescent condition for a period of hours and then washed with water.

A. F. Endres. U.S.P. 1,996,236, 2.4.35. Stabilized naphtha is treated with caustic alkali solution and then with sodium plumbite. The latter is next contacted

with unstabilized naphtha, thereby simultaneously sweetening the naphtha and regenerating the plumbite solution for further use with stabilized naphtha.

R. E. Burk and E. C. Hughes. U.S.P. 1,997,480, 9.4.35. Motor fuel is prepared by heating gasoline vapour for 0·075 to 1 second at 840–1300° F. in the presence of 0·5 up to 5 volumes of air, without materially changing the end-point of the total condensate.

G. Egloff and J. C. Morrell. U.S.P. 1,997,861, 16.4.35. Distillate is treated in the vapour phase with an aqueous solution of hypochlorous acid having dissolved therein a salt of copper.

W. A. Schulze. U.S.P. 1,998,849, 23.4.35. Oil is desulphurized by treatment with an alkaline solution which, when spent, is regenerated by treatment with a chlorine-yielding oxidizing agent.

L. V. Chaney and W. A. Schulz. U.S.P. 1,998,863, 23.4.35. Alkaline treating solutions are regenerated by treatment with a gas containing free oxygen at elevated temperatures. Disulphides are removed from the regenerated reagent by means of gas oil.

A. E. Dunstan. U.S.P. 1,999,041, 23.4.35. Treatment of hydrocarbons with a dilute solution of alkaline sodium hypochlorite.

T. Scott. U.S.P. 1,999,112, 23.4.35. Refining motor fuels at 40–80° C. by percolation for at least 30 seconds through a bed of ferric sulphate and inert material which acts to retain the ferric sulphate in a sufficiently open condition to allow flow through the bed. W. H. T.

Stand. Oil Dev. Co. D.R.P. 607,986, 13.5.32. Spent alkaline liquors are treated with oxygen under elevated temperatures and pressures for the formation of disulphides.

Aktiebolaget Separator. D.R.P. 609,335, 1.7.33. Plumbite-refining, using centrifugal separators for the separation of gasoline and reagent.

N.V. Machin. App. Fabrik. D.R.P. 611,064, 2.6.33. Cracked benzine is refined by treatment in the liquid phase with bleaching earth, followed by vapour-phase treatment with contact masses impregnated with zinc chloride.

Univ. Oil Prods. D.R.P. 611,172, 24.5.32, and 611,339, 20.4.32. Treatment of cracked benzine with hydrochloric acid in the presence of a metal and water vapour at a temperature of above 200° C. and under such a pressure that the distillate is maintained in the liquid phase. L. S.

699. Patents on Kerosine. R. Dight. E.P. 426,216, 29.3.35. A pressure lamp comprising a reservoir surmounted by a preheating device consisting of a circular tube connected by two straight portions with the reservoir. A burner orifice is formed in the upper surface of the lower portion of the circular tube so as to heat the two curved portions of the tube. Wicks depend into the reservoir from the straight portions of the tube. W. H. T.

700. Patents on Lubricating Oil. Int. Hydn. Pat. Co. E.P. 425,814, 21.3.35. Production of lubricating oil by the hydrogenation of coal. The lubricating oil fractions are solvent-refined and treated with hydrogen under pressure at 300–450° C. in the presence of catalysts.

J. Y. Johnson. E.P. 425,893, 18.3.35. Lubricating oils are produced from paraffin wax or oxygen-containing aliphatic hydrocarbon derivatives (mol. wt. above 250) by heat treatment (300–450° C.) in the presence of elements of the fifth and eighth groups of the periodic system.

W. J. Tennant. E.P. 426,221, 29.3.35. Solvent extraction of lubricating oil by means of chloraniline.

E. Kramer. E.P. 426,237, 29.3.35. A graphite-lubricant in which the graphite is reduced to colloidal dimensions by the impact of elements, the working surfaces of which have a large curvature whereby line or point contact of the elements is obtained. W. H. T.

A. Berne-Allen, Jr. U.S.P. 1,993,256, 5.3.35. A process is described for dewaxing petroleum oils by separating the distillate into two fractions, one containing a minor portion of the wax content of the oil and the other containing a major portion. A considerable quantity of the wax is removed from the latter portion, and this dewaxed fraction is blended with the undewaxed lighter fraction.

H. T. Bennett U.S.P. 1,993,396, 5.3.35. Removal of crystalline wax from

lubricating oils by adding a soap, *e.g.* aluminium stearate, which is insoluble in water, and a diluent, *e.g.* naphtha. The resultant mixture is chilled to — 20° F., and centrifuged to remove the wax. The diluent is then removed.

I. M. Perkins and F. B. Hobart. U.S.P. 1,994,485, 19.3.35. Separation of wax from oil-wax mixtures, especially from those adapted to sweating. The molten mixture is passed counter-current with a cooling fluid which is immiscible with the mixture and has a different specific gravity. The mixture is cooled slowly, so that a small proportion of the wax crystallizes and forms agglomerate crystals on agitation. The agglomerates are then separated from the liquid constituents of the oil-wax mixture and cooling fluid.

M. G. Paulus. U.S.P. 1,994,727, 19.3.35. Removal of last traces of solvent in solvent refining processes, *e.g.* dichlorethylether. The oil is stripped with hot dry inert gases to remove water, and further stripping at high temperatures enables the removal of the solvent, which in turn is removed from the stripping gases.

F. X. Govers. U.S.P. 1,995,147, 19.3.35. Production of oils of high viscosity index and low cold test from wax-bearing fractions of mineral oil. The fraction is mixed with benzaldehyde *iso*propyl ether in such proportions that at temperatures of about 0° F. the mixture has a complete solvent action on the oil and no action on the wax. The mixture is cooled to precipitate wax which is removed. The solvent is then removed from the dewaxed mixture.

B. Y. McCarty and W. E. Skelton. U.S.P. 1,995,153, 19.3.35. Removal of wax from hydrocarbon oil by mixing it with ortho-dichlorbenzene ethylene dichloride in such proportions that at — 10° F. the mixture has complete solvent action on the oil and none on the wax.

R. H. Gardner. U.S.P. 1,995,740, 26.3.35. Dewaxing hydrocarbon oils by chilling the paraffin distillate and a diluent oil of lower boiling range and pressing to separate wax. The diluent oil is then distilled from the pressed stock mixture to separate the neutral oil and a chilled mixture of separated wax and diluent oil pressed to separate crystalline wax. Any diluent oil is distilled from the wax.

E. J. Martin. U.S.P. 1,995,744, 26.3.35. Dewaxing hydrocarbon oil by chilling and pressing. The paraffin distillate and diluent stock are cooled separately to the pressing temperature, and these are mixed in the proportion of 70% of the paraffin distillate to 30% of the diluent stock and pressing the mixture.

H. Kaehler and H. Klein. U.S.P. 1,996,008, 26.3.35. American gas oil containing sulphur is refined by treating it with hydrogen at 400° C. and under 100 atmospheres pressure in the presence of a mixture of iron oxide with a solution of cobalt nitrate containing cobalt in amounts up to 10% of the iron and evaporating the mass to dryness.

G. R. Duffy. U.S.P. 1,997,295, 9.4.35. Waste lubricating oils are re-refined by heating them with clay in an atmosphere free from oxygen (obtained by passing hot waste flue gases through pyrogallic acid and injecting the gases into the mixture). The mixture is finally filtered to remove clay, etc.

W. S. Baylis. U.S.P. 1,997,896, 16.4.35. Refining of asphalt-base petroleum oils. The oil is agitated with concentrated sulphuric acid and the oil separated from the sludge. The oil is then mixed with decolorizing clay and passed through a heating zone to vaporize the light fractions. The mixture is then introduced to a fractionating zone in which the heavier fractions are separated and withdrawn at the point of entry and the light fractions ascend to the top of the zone. The mixture of unvaporized lubricating oil and clay are removed from the zone and the clay is separated.

N. E. Loomis. U.S.P. 1,997,938, 16.4.35. Lubricating oil is refined by passing it through an elongated heating zone of narrow cross-section and mixing a solid adsorbent material with the oil as it issues from the heating zone. The slurry of oil and adsorbent material is then passed through an elongated narrow zone which is maintained at a uniform temperature and then to a fractionating zone to remove light products. The residual oil and clay are then removed and the clay is separated.

E. J. Smith. U.S.P. 1,998,292, 16.4.35. Refining of lubricating oil by adding from 0·01–3% of furfural to the oil before acid-treating. This decreases the settling time for the acid sludge. The desired bloom in the oil is then obtained.

B. Y. McCarty and W. E. Skelton. U.S.P. 1,998,397, 16.4.35. Solvent extraction of lubricating oils using a mixture of *iso*propyl ether and a liquid selected from the group consisting of ethylene dichloride and propylene dichloride in such proportions

that the mixture has complete solvent action on the oil and none on the wax at − 10° F.

B. Y. McCarty and W. E. Skelton. U.S.P. 1,998,398, 16.4.35. Solvent extraction of lubricating oils similar to that described in the above patent except that the solvent is a mixture of ethylene dichloride with the group consisting of tertiary amyl alcohol and a mixture of normal amyl alcohol with its principal isomers and ethylene dichloride.

E. F. Pevere. U.S.P. 1,998,399, 16.4.35. Solvent refining of hydrocarbon oil using hydrogenated furan-tetrahydrofurane.

I. M. Perkins and S. S. Kurtz. U.S.P. 1,998,464, 23.4.35. Separation of oil-wax mixtures which are adapted to sweating.

J. A. Anderson. U.S.P. 1,998,648, 23.4.35. Dewaxing lubricating oils by adding a small quantity of a synthetic product formed by the action of aluminium chloride on naphthalene with chlorinated wax, diluting the oil with a diluent, chilling the mixture and centrifuging to remove the wax. The diluent is then removed from the wax-free oil.

C. E. Adams. U.S.P. 1,998,747, 23.4.35. Recovery of maximum yields of wax of high m. pt. from mineral oils by mixing the stock with propane and a crystallization regulator and chilling the mixture to 0° F. to effect solidification of the wax in the form of a dry cake. This cake is sweated to remove wax of low m. pt., oil and the crystallization regulator from the wax of high m. pt. The crystallization regulator is recovered for re-use.

W. B. Logan. U.S.P. 1,998,765, 23.4.35. Process for neutralizing organic acidity in petroleum lubricating oils by mixing them with aqueous caustic soda solution and passing it through a heating coil and rapidly heating it to 750° F. and under a pressure sufficient to keep the oil liquid. The hot mixture is flashed immediately, without previous removal of water vapour, into a fractionating zone under high vacuum. The unvaporized oil is passed downward to the lower part of the zone for further distillation, and the vapours are fractionated to condense the lubricating oil distillate. W. S. E. C.

M. Buchholz. D.R.P. 609,983, 13.5.33. Dehydration of insulating oil by atomization under vacuum.

Aktiebolaget Separator Co. D.R.P. 610,807, 30.9.33. Oils are dewaxed by mixing them with a solvent of higher specific gravity than that of the heaviest paraffin to be separated. The mixture is chilled and centrifuged with an aqueous solution of $CaCl_2$, $MgCl_2$, $ZnCl_2$, glycerin or alcohol.

O. Bühring. D.R.P. 610,851, 18.10.33. Apparatus for reclaiming used lubricating oil.

Edeleanu Ges. D.R.P. 611,044, 6.11.33. Lubricating oils of high viscosity index are obtained by extracting crude lubricating oil with liquid SO_2 at above 30° C.

Aktiebolaget Separator Co. D.R.P. 611,703, 16.4.33. Dewaxing oil by centrifuging the latter in admixture with a heavy solvent. In the first stage, an oil rich in paraffin is separated and in the second stage it is divided into paraffin and an oil of low paraffin content.

I.G. Farbenind. A.-G. D.R.P. 612,015, 15.5.32. A graphite lubricant in which the protective colloid is the esterification product of amines.

I.G. Farbenind. A.-G. Austr. P. 141,152, 21.1.35. Improvement in lubricating oils by the addition of small amounts of a condensation product, produced by subjecting paraffin wax to the effect of a silent electric discharge. L. S.

701. Patents on Fuel Oil. J. Classen. D.R.P. 611,968, 12.1.33. Fuel oil suspensions of finely divided active carbon in furfural mixed with liquid fuels together with a protective colloid.

A. Hagemann. D.R.P. 612,073, 16.6.31. In order to improve the ignition properties of coal-tar diesel oil, autoxydizable substances are added (*e.g.* aldehydes, ketones, fats, ethereal oils, etc.). L. S.

702. Patents on Asphalt. Du Pont de Nemours. E.P. 425,217, 11.3.35. A wetting, emulsifying and dispersing agent which is prepared by esterifying abietic or hydroabietic acid with (*a*) a halogeno-aliphatic or halogeno-*cyclo*aliphatic sulphonic acid in an alkaline medium or (*b*) hydroxyaliphatic or hydroxy*cyclo*aliphatic sulphonic acid in the presence of hydrogen chloride or sulphuric acid, or (*c*) by esterifying the abietic

or hydroabietic acid chloride with an alkali metal salt of a hydroxyaliphatic or hydroxy*cyclo*aliphatic sulphonic acid.

Maschinenfabrik Komnick Ges. E.P. 426,162, 28.3.35. Road-covering blocks are formed by impregnating moulded masses of lime and sand with liquid bitumen. The moulded masses have a resistance to compression between 10 and 50 kgm. per sq. cm. before being subjected to impregnation with liquid bitumen.

E. Rouault. E.P. 421,269, 6.12.34. Preparation of aqueous emulsions in which water is dispersed in natural or artificial bitumen. The latter is mixed with tar or pitch from coal, shale or wood, together with water containing alkali capable of reacting with the phenolic constituents of the tar or pitch.

F. J. Skowronski. U.S.P. 1,993,532, 5.3.35. Asphalts of high ductility are prepared by mixing asphaltic cracked residue with neutral tar from acid sludge and air blowing the product.

E. W. Gard and B. G. Aldridge. U.S.P. 1,999,018, 23.4.35. An oxidized asphalt is produced from a naphthenic base crude oil by oxidation of certain of its fractions. The product has a melting point of 375–300° F., a penetration of 10–15 and a ductility of 0·5 to 2 cms. at 77° F. W. H. T.

Hanseatische Mühlenwerke. D.R.P. 594,189, 6.4.34. Solid alkali is used instead of aqueous alkaline solutions for making emulsions.

P. Lechler. Austr. P. 141,162, 18.9.33. Emulsions which, after drying, produce dense coatings, are prepared from natural or artificial bitumen, wax, resin, etc., by combining emulsions of low- and high-melting-point bitumens. L. S.

703. Patents on Special Products. Bat. Petm. Mij. E.P. 424,867, 25.2.35. A process for splitting up a liquid mixture into its components A and B by treatment with a selective extracting agent which dissolves A more readily than B. The solution of extract is then washed at uniform temperature with liquid A.

Carbide and Carbon Chemicals Corpn. E.P. 425,728, 20.3.35. Glycol ethers are preserved against deterioration due to storage, by the addition of less than 1% of hydroxyalkylamine.

B. Clayton. E.P. 425,986, 20.3.35. Porous fibrous material is rendered oil-proof by application on one side of an aqueous solution of soap having a base of monovalent metal or triethanolamine, which may also contain a plasticizer.

E. I. Du Pont de Nemours. E.P. 426,051, 25.3.35. Emulsions having insecticidal or fungicidal properties are prepared by emulsifying in water, a mineral or fatty oil in the presence of casein, a base and a tetra-alkyl-thiuram monosulphide, with the addition, if desired, of oleic acid.

E. I. Du Pont de Nemours. E.P. 426,102, 25.3.35. Preparation of insecticides by emulsification of a solution of an aryl mercury compound in a mineral oil with an alkaline aqueous solution of casein.

Monsanto Chemical Co. E.P. 426,175, 28.3.35. Para-cresol is separated from other phenols by the formation of a solid addition compound of *para*-cresol and oxalic acid. The addition product is resolved into its constituents by the action of heat in the absence of water and below the decomposition temperature of oxalic acid.

Bat. Petm. Mij. E.P. 426,519, 4.4.35. A process for manufacture of chlorhydrin in which an aliphatic olefin is subjected to the action of free hypochlorous acid and hydrochloric acid, the reacting materials being in a finely divided condition.

W. Piotrowski and J. Winkler. U.S.P. 1,996,692, 2.4.35. Olefines, ketones, alcohols, mono- and di-sulphides, mercaptans, etc., are obtained from acid sludge by treatment with dilute aqueous alkali and steam distilling the separated oily layer, the residue being subsequently distilled under cracking conditions. W. H. T.

F. Fischer and K. Peters. D.R.P. 591,756, 20.10.29. Acetone is produced from methane, etc., by mixing the gas with less than the equivalent of water vapour and subjecting the mixture to a silent electric discharge, at high velocity and at reduced pressure.

E. I. Du Pont de Nemours. D.R.P. 601,504, 25.6.31. Polymerization of non-benzenoid acetylene polymers.

Standard Oil Dev. Co. D.R.P. 605,444, 6.1.33. Acid tars are converted into sulphonic acids and sulphonates by neutralization with alkali followed by treatment with liquid ammonia. Insoluble matter is separated and the ammonia is distilled off, yielding a bright powder which is soluble in cold water.

I.G. Farbenind. A.-G. D.R.P. 606,083, 25.12.30. Sulphuric acid esters of alcohols are produced by heating the alcohols with salts of the imido-disulphonic acid or with salts of the acid sulphuric acid esters of alcohols with a smaller molecule than that of the alcohol to be esterified. The mixture of primary, secondary and tertiary alcohols as produced by oxidation of paraffin is treated with potassium salts of ethylsulphuric acid, whereby the potassium salt of the corresponding sulphuric acid ester is produced.

H. Harter. D.R.P. 606,695, 7.3.28. Oxidation of methane, benzene, or toluene, etc., by air or oxygen in the presence of nitrogen oxides as catalysts.

Oranienburger Chem. Fabrik. D.R.P. 607,018. High molecular sulpho-acids or their salts are formed by treating neutral fats or fatty acids mixed with hydrocarbon oils, with mixtures of sulphurizing agents. The mixture is finally dehydrated.

Bat. Petm. Mij. D.R.P. 608,360, 29.11.29. Mono-halogen substitution products are obtained by mixing propane, butane and pentane with halogen at low temperatures in the absence of light. The gas mixture obtained is preheated to reaction temperature.

I.G. Farbenind. A.-G. D.R.P. 608,362, 12.8.27. The neutral oxidation products produced by incomplete oxidation of paraffins are treated with sulphonating agents. The products are water soluble materials which may be used as wetting, purifying and dispersing agents.

Federal Phosphorus Co. D.R.P. 609,865, 20.3.31. Diphenyl is produced by heating benzene to about 800° C. in reaction vessels coated with certain metals, their oxides or sulphides.

A. Chwala and E. Waldmann. Austr. P. 141,026. Oil emulsions are produced by the use of emulsifying agents, comprising mixtures of neutralized, sulphurized animal or mineral oils with compounds having at least three double carbon bonds in the animal constituent and combined with the soaps of unsaturated fatty acids.

Distillers Co. Austr. P. 141,030, 15.11.34. Ethyl alcohol is produced from ethylene by admixture with water vapour at above 100° C. in the presence of catalysts. L. S.

704. Patents on Coal. E. W. Brocklebank and W. B. Mitford. E.P. 426,645, 8.4.35. Production of coke by destructive distillation at 350–550° C. of coal–oil mixtures using an externally heated inclined rotating cylindrical retort.

D. L. Jacobson. U.S.P. 1,993,344, 5.3.35. Removal and recovery of light oil from coal gas by scrubbing the latter with tar. W. H. T.

J. Myer. D.R.P. 606,779, 7.2.33. Production of pure phenols from brown-coal or shale tar or primary tar. The tar is preheated, fractionated and the distillate treated with water vapour at 100–120° C., the phenolate being freed from impurities.

Barret Co. D.R.P. 608,332, 13.3.28. Dehydration of tar by direct contact with hot coal-distillation gases.

E. Karpati and G. Schay. Austr. P. 158,434, 14.9.33. Coal tar distillates are purified with dilute potassium permanganate solution (1–2%) in the presence of 1–2% of mineral acid or caustic alkali, preferably at super-atmospheric pressure. The manganese sludge is removed, the oil is washed with water, treated with condensing or polymerizing agents (caustic alkali, metallic oxides, etc.) and then distilled. L. S.

Class 700. Utilization.

705. Toxicity of Motor Exhaust Gases. R. Ponchon. *Rev. Comb. Liq.*, 1935 (13), **122**, 49–54.—The article is a reply to a paper, published in the *Presse Medicale* of October 10th, 1934, and reproduced in various other publications, which described the ill effect produced by the exhaust gases from a diesel engine lorry on the health of the driver and showed the diesel engine to be a public danger.

In the present paper the toxicity of exhaust gases produced by gasoline and diesel engines is examined. A large amount of work on this problem has been carried out, the results of which tend to show that the diesel engine is less injurious to health than the gasoline engine. Reference is made to the work of Emile Kohn-Abrest, particularly to his paper read before the 5th Congress of Industrial Chemistry in 1926.

Kohn-Abrest, who dealt only with the gasoline engine, the diesel engine not being then in a sufficiently advanced stage of development, suggested the classification of all systems using any fuel whatsoever by the ratio $\frac{CO}{CO_2}$ produced after combustion and which he called the Toxicity Index.

Tables are reproduced showing analyses of exhaust gases produced under various conditions, and using various types of motors, the Toxicity Index varying between 0·075 and 2·00. The lowest figure (0·075) was given by a 35-H.P. 4-cyl. engine of the type used then on the Paris 'buses, having a 100-mm. bore and a cylinder capacity of 5·652 litres, the fuel used being "Essence Tourisme." The same engine, however, gave a Toxicity Index of 0·57 when used under similar conditions (25 Km/H.), but with "Essence Poids Lourd" as fuel.

The highest Toxicity Index (2·00) was given by a 17 H.P. 4-cyl. engine, having a cylinder bore of 85 mm. and a cylinder capacity of 3·168 litres, when the car was at a standstill and the engine just turning over; the fuel in this case being "Essence Tourisme." Kohn-Abrest reaches the following conclusions from the tables mentioned above:—1. The Toxicity Index of gasoline engines appears to be a characteristic of the engine and which depends essentially on the manufacturing details of the carburettor. 2. The Toxicity Index is hardly influenced by speeds up to 100 Km/H. or by atmospheric conditions. This index is, however, doubled when the engine is just turning over, the car being at a standstill. On the other hand, smoke produced during starting does not increase the Toxicity Index, and therefore the coloured exhaust gases are not more, and are sometimes even less toxic than the invisible exhaust gases. 3. Certain types of engines have a very low Toxicity Index, whilst the majority have a fairly high index, the average being 1, increasing to 2 when the engine is just turning over.

The results are compared with those obtained by the "Station Nationale de Recherches et Experiences techniques de Bellevue" on the Peugeot Junkers 1 PJ 60 and the Saurer BOD diesel engines using gas oil as fuel. A Toxicity Index of 0·045 and 0·030 was obtained at speeds of 1500 and 1000 r.p.m., respectively, these values being considerably lower than those given by the gasoline engines described previously. Analysis of exhaust gases by the Manchester Corporation Transport in 1932 and 1934 on four 'buses, two fitted with gasoline engines and two with diesel engines are given, and these show that whilst the Toxicity Index for the gasoline engines was found to vary between 0·35 and 1·4, depending on conditions, running, etc., the diesel engine exhaust gases gave a Toxicity Index varying between 0·01 and 0·05 or 28–35 times lower.

Mention is also made of a report by the London Passenger Transport Board on the analysis of exhaust gases, wherein it is stated that diesel engine gases do not generally contain CO, and never in quantities greater than 0·2%. Typical analysis tables are also given, the conclusion reached being that the petrol engine gives off exhaust gases which are far more toxic than those produced by the diesel engine, as a Toxicity Index varying from 0·03 to 0·13 was obtained from the former whilst the latter gave an Index of 0. M. M. L.

706. 100 Octane Aviation Fuel. Anon. *Petr. World*, 1935, **32** (414), 68–69.—Gives a précis of a paper by F. D. Klein (U.S. Air Corps) on "Aircraft Engine Performance with 100 Octane Fuel." This paper described the tests carried out in Wasp and Cyclone engined planes as well as those on the test bed. The 100 octane fuel used consisted of 50% *iso*-octane plus 50% aviation gasoline, the mixture containing 3 ml. lead. The author stated that the marked increase of 15% to 30% in power output possible with this fuel (100 octane) over that obtainable with 92 octane fuel by the Air Corps knock method of test clearly demonstrated not only the advantage of this fuel, but also, more important, the extreme desirability from a military standpoint of adopting such fuel as a means of greatly increasing engine performance with relatively little increase in weight provided that engines are designed to take full advantage of the higher anti-knock value fuels. In the discussion Dr. G. Edgar indicated the possibilities of these fuels in commercial air transport, and sketched the most likely methods of producing such fuels. G. R. N.

707. Anti-Detonants. E. Bossing. *Chem. Ztg.*, 1935, 316.—The chemistry and technology of anti-detonants are discussed; the anti-detonants described are either

metal compounds or pure organic substances; the use of these two groups is exemplified by about 50 patents. L. S.

708. Diesel Fuels from Brown Coal. A. W. Schmidt. *Braunk.*, 1935, **34** (4), 49–53, (5), 72–75.—Experiments have been made with brown coal tar derivatives as motor fuels for diesel engines. By special means, the time interval between the beginning of the injection of the fuel and the initiation of combustion could be measured and indicated diagrammatically by a Maihak indicator; the delay of ignition has been expressed as degrees of crank angle. Raising the compression ratio from 12 : 1 to 17 : 1 improves the delay of ignition by nearly 50%.

The method of injection (chiefly depending on the nozzle construction) is of considerable effect on the process of ignition. The same is true with regard to the preheating of air. The influence of viscosity and of the solidifying point of the oils have also been studied. Neither the physical nor the chemical constants show any connection with behaviour in the motor, but a certain relationship seems to exist between the content of creosote and of paraffin, for a high content of creosote seems not to be too disadvantageous if at the same time the paraffin content is higher. A parallel tendency seems to exist between the aniline point curve and the curve of the delay of ignition. L. S.

709. Synthetic Alcohols and Related Products from Petroleum. B. T. Brooks. *Ind. Eng. Chem.*, 1935, **27** (3), 278.—I. *Olefine Raw Materials.* The most prolific source of gaseous olefines is the gas from oil-cracking plants. A short review of the early development of olefine utilization is given. Propane and butane are suggested as possible sources of ethylene and propylene by thermal decomposition. Cracking in the vapour-phase normally gives a gas containing 40–50% olefines (ethylene 20–24%), and an example of quantities produced is given for a typical vapour-phase plant yielding 4,500,000 cu. ft. of gas per day, containing (in tons): ethylene 40·4, propylene 38, butenes 29·9, amylenes 19·7, hexenes and gasoline 15·5. The ratios of olefine to paraffin for gas made at 595° C. (V.P.) are: ethylene to ethane, 100 : 51; and propylene to propane 100 : 30. The butene fraction analysed: butanes 10–12%, *iso*butene 20–24%, *n*-butenes 50–55%, butadiene 12–14%, C_3 and C_5 2%. A C_4 fraction from the Cross process contained only 22% butenes and no butadiene. Both 1- and 2-butenes are found in the C_4 fraction and 1-pentene, 2-pentene, trimethylethylene, *iso*propylethylene and only small amounts (about 1%) of dienes are found in the C_5 fraction.

The various methods of concentrating and purifying the olefines are reviewed. These include: adsorption by charcoal, liquefaction and distillation, oil absorption and rectification and sulphuric acid. Mention is made of the ease with which *iso*butene reacts with acids and cuprous chloride is suggested for the selective removal of butadiene.

II. *Manufacture of Alcohols and Esters.* The statement is made that sulphuric acid is the only reagent now used industrially for the conversion of olefines to alcohols. The formation and hydrolysis of the alkyl sulphates, and the production of sultone and carbyl sulphate are briefly discussed. Reference is made to polymerization of the olefines both by acid and by thermal treatment for the production of motor spirit. Previous work on the production of ethyl, *iso*propyl, secondary butyl, amyl and hexyl alcohols is reviewed. Mention is made of the polymerization of *iso*butene to di*iso*butene followed by hydrogenation to *iso*-octane; it was found possible to remove selectively the *iso*butene using 65% sulphuric acid without polymerizing the butadiene present. Various methods of esterification are discussed. E. N. H.

710. Experiments on Exterior Water-proofing Materials for Masonry. D. W. Kessler. *Bur. Stand. J. Res.*, 1935, **14**, 317–343.—An investigation was carried out to ascertain the effectiveness and durability of various types of water-proofings, twenty-nine proprietary materials, ten non-proprietary treatments and a few purely experimental processes being included in the tests.

The proprietary materials comprised thinned fatty oils both with and without the addition of paraffin wax, thinned varnishes, aluminium soap solutions, aqueous emulsions of glues, soaps and wax and solutions of wax in light distillates. The non-proprietary treatments included silicate solutions, various inorganic salt solu-

tions and wax in benzole and gasoline solutions. The masonry used for these experiments were limestone, sandstone, marble, brick, cast stone, and mortar.

The effectiveness of water-proofing was rated by the ability of the treatment to reduce the absorption rate of the masonry material, whilst durability was examined by exposure to weather for periods up to 13 years.

Wax types were found to be the most durable, although discolouring most of the masonry materials. Wax dissolved in volatile solvents and molten wax applied to heated materials were the most effective, whilst aqueous emulsions of waxes, varnishes and lacquers which produce a surface film were not very satisfactory.

Fairly satisfactory durability was indicated for the thinned fatty oils, and these could be improved by incorporation of a high melting-point paraffin wax.

The insoluble soaps gave no discoloration, but were not very durable, whilst treatments consisting of two reacting solutions designed to produce an insoluble precipitate, and those intended to react with the masonry were for the most part ineffective.

It was evident that the effectiveness of all materials was largely dependent on the pore size of the masonry.

The study of preservative value was not sufficient in scope to be conclusive, but evidence was obtained that effective water-proofing retards the deterioration of masonry due to the more common weathering actions. D. L. S.

711. Nitric Acid in Used Lubricating Oils. C. Ehlers. *Petr. Zeit.*, 10.4.35, **31** (15); *Motorenbetrieb.*, **8** (4), 2–3.—This article deals with the formation of nitric acid and nitro-compounds in motor fuels; it is claimed that nitric acid is formed by combustion of atmospheric nitrogen and oxygen in the cylinder which is converted into nitric acid in the presence of moisture. Organic nitro-compounds are formed only under special conditions.

In view of the fact that nitric acid is formed when water is present, the sludge from the water determination using xylol is tested for this compound by means of diphenylamine sulphuric acid. The acid aids any corrosive action on the metal parts. W. S. E. C.

712. Surface Tension of Solids. Anon. *Roads and Road Constr.*, 1935, **13**, 77.—This article refers to investigations made by Loman and Zwikker (*Physica*, 1934, **1**, 1181), in connection with the determination of surface tension of solids by the measurement of the angle of contact between the solid and a liquid of known surface tension. Antonow's equation for the contact angle-surface tension relationship is stated to be confirmed by measurements made on a large number of solids. Figures for surface tension of different types of stone and for a very hard asphaltic bitumen are given. The surface tension of asphaltic bitumen at 182° C. is said to be lower than the lowest figure obtainable for stone, and no difficulty in coating stone with hot bitumen is therefore experienced. Tars, however, have surface tensions 8–12 dynes/cm. higher than bitumen, and stone may consequently have a lower surface tension than tar, thus resulting in imperfect wetting and spreading of the tar on the stone. A. O.

713. Improved Applications of Rock Asphalt. E. Gola. *Roads and Road Constr.*, 1935, **13**, 43.—This article discusses experiments carried out in Milan using rock asphalts for the construction of compressed asphalt pavement. In the first experiments a mixture of Ragusa rock, asphaltic bitumen of 85–100 penetration, flux oil and limestone of 0–3 mm. grading was used. The addition of powdered asbestos for the purpose of reducing slipperiness was also tried, but since this object was not achieved, its use was discontinued. After two years' use the pavement was found to be in good condition, except for slight slipperiness on the side of the road more exposed to the sun. In later experiments a coarser sand was substituted for the limestone powder and smaller quantities of bitumen and rock asphalt were used without flux oil, mixtures being prepared with Ragusa, Abruzzi rocks and with equal parts of these, whilst in one case a mixture in which the asphaltic bitumen was replaced by tar was prepared with Abruzzi rock. The various pavements are stated to be in good condition and sufficiently rough. The analysis of samples taken from the surfacings is given. A. O.

714. Contact Insecticides. F. Tattersfield. *Chem. Trade J.*, 1935, **96**, 231, 251, 273.—A brief summary is given of the uses and suitability of horticultural insecticides of different types, and recent developments in the production and evaluation of pyrethrum and derris products are described in more detail. Dormant sprays with powerful chemical action are employed as a preventive measure before the insects develop (*e.g.* caustic washes, tar and petroleum distillates), but they cannot be used when foliage or fruit is on the tree. The insect poisons used under these conditions are of three types: (1) stomach, (2) contact, (3) respiratory poisons. Type (1) includes arsenates of which $PbHAsO_4$ and $Ca_3(AsO_4)_2$ are the chief examples in use. Compounds less poisonous to animals, *e.g.* Ba silicofluorides and the fluoroaluminates (cryolite), are under investigation, but the ideal stomach poison insecticide has not yet been produced.

Type (2) includes nicotine, the dipyridyls, anabasine, various thiocyanic esters, coal-tar and petroleum distillates, pyrethrum and derris-root products.

Pyrethrum (mainly chrysanthemum cinerariæfolium) is cultivated in Japan and Dalmatia and to a smaller extent in Kenya, trials also being carried out in S. Rhodesia and England. The world production of pyrethrum flowers in 1932 is given as 16,000,000 lb.

The work of various investigators on the isolation and structure of the active principle of pyrethrum is described, and the methods of chemical evaluation of the pyrethrin esters 1 and 2 are referred to. The loss of insecticidal activity of pyrethrin on storage is shown to be partly due to oxidation, being strongly activated by light and heat. Extracts of pyrethrum in solvents are, however, relatively stable in containers shielded from the light.

A list is given of the fish poisoning plants, of which derris and lonchocarpus, which contain rotenone, are the most important. Derris root is now cultivated on a large scale, the exports from Malaya being 642 tons in 1933 and the production at Cubé in Peru being 300 tons. Besides the main active principle, rotenone, the resin left after its extraction contains several toxic constituents which have been isolated, deguelin—an isomer of rotenone—being the best known. The chemical constitution of rotenone and deguelin are discussed.

Work on the chemical standardization and correlation with insecticidal activity of derris root and the methods of incorporation into insecticides is described.

Rotenone loses its activity in air, so that the use of the more stable dihydrorotenone has been suggested. It is equally as toxic as the pyrethrins, and much more toxic than nicotine to susceptible insects.

In addition to its use as a general plant and animal insecticide, derris root has been found valuable in the control of the raspberry beetle and the warble fly. Reference is made to literature describing the results of tests on rotenone and derris towards a number of insects. C. L. G.

715. Dust-Proofing of Coal. M. G. Van Voorhis. *Nat. Petr. News*, 13.3.35, **27** (11), 116.—The use of petroleum for the dust-proofing of coal has met with conspicuous success, but a full measure of success is obtained only by the use of an oil suited to the particular coal. An extensive investigation has been started to draw up specifications for oil for this application. A draft specification is already available. The rate of application is 3 quarts of oil per ton of coal. The viscosity of oils in common use is 100–225 secs. S.U., and it appears that soft coals need a higher viscosity oil than hard coals. Treated coal is said to be improved from several points of view apart from the absence of dust—namely, better ignition, more efficient burning, more easily handled clinker, more easy handling of the coal in freezing weather, etc. Complaints concerning treated coal have usually been due to the use of the wrong grade of oil, the use of too much oil or bad distribution of the oil over the coal. H. G.

716. Patents on Engines. Soc. des Brevets Catalex. D.R.P. 609,489, 6.12.30. Before entering the cylinder of the engine, the fuel is treated with an alloy of 98% of copper and 2% of aluminium with small proportions of ferromanganese and ferrosilicon, the alloy being heated by the exhaust gases. L. S.

BOOK REVIEWS AND BOOKS RECEIVED.

Reviews.

RIG-BUILDING. R. C. Paget. Pp. xii + 104. 1935. Williams & Norgate, London. 10*s.* 6*d.* net.

This book is a practical treatise covering the design and erection of wood rigs and derricks.

The author commences by discussing the design of wood derricks, and defines the basic practical principles to ensure maximum strength of the derrick and its component parts.

Tables of allowable loads are given for derricks of 72, 80, 84, 122 and 136 ft. in height using Southern Pine, Douglas Fir and Redwood. A complete draft for a 83-ft. × 22-ft. × 6-ft. derrick is given, clearly indicating the mathematical method used by the author in arriving at the dimensions of the various parts of the derrick.

Chapter II deals with the construction of the rig. The sizes and method of construction are given for bullwheel posts, calfwheel posts, jack posts, knuckle post, swing lever and tail sill and post. The foundation timbering of the rig is fully described in practical detail.

The author then proceeds to the installation of bullwheel, crown block, calfwheel, jack posts, bandwheel, crankshaft, sand reel (friction and chain driven), samson post and walking beam.

Complete detail and arrangement drawings are given showing sizes and method of cutting all timbers. Many practical points in erection are dealt with, which are the result of the author's experience.

Chapter III describes the cutting out and erection of the derrick. This is done in great detail, and is full of helpful suggestions for the rig builder. The functions of each man in an erection crew of six men are given in a thorough manner, which indicates the considerable thought the author has given to this subject.

In Chapter IV the differences between rotary and combination rigs are discussed. These are illustrated by drawings, and are followed by a chapter on housings. Two complete scale drawings describe in full detail housings of the "enclosed-walk" and "open-walk" type, and these are ably commented on in the text.

Chapters VI, VII and VIII deal with building a wooden bandwheel, derrick guys and throwing a derrick.

Chapter IX contains eleven tables to be used in computing derrick timbers, and is complete with examples and typical calculations.

The remainder of the book is occupied by specifications of material common to all cable tool rigs irrespective of size of derrick or type of housing, specifications of materials for housings and specifications of derrick materials for nine derricks ranging in height from 75 ft. to 131 ft.

The book is well written, and bears the stamp of the practical man who offers to the reader the solution to many difficulties which confront the rig builder.

In his Foreword the author voices the opinion that many years will elapse before wood rigs and derricks become an unfamiliar oil-field sight. One may agree with this, because many oil-producing countries have plentiful native timber of suitable quality, and would require to import steel derricks, which present economic conditions make somewhat prohibitive. None the less, one cannot agree that, taking the long view, the wood derrick is more economical than the steel derrick. Its salvage value shows a much greater depreciation than does that of the steel derrick. Neither can the author successfully defend his contention that fire hazards for wood derricks are no more serious than for steel derricks.

The book may be strongly recommended to the rig builder, and is a valuable addition to the oil well engineer's library. L. S. DAWSON.

INTERNATIONAL COAL CARBONIZATION. John Roberts and Adolf Jenkner. Pp. xvii + 453. 1934. Isaac Pitman & Co., London. 35*s.* net.

The high standing of the authors in the domain of fuel gives this work an authenticity that will be appreciated by all readers who are connected with the carbonization

industries. It is likely to be of value not only to the fuel technologist and his commercial associates, but also to the increasing number of students in the various branches of science concerned with the proper application of fuel.

The authors justly point out that a knowledge of the fundamental principles of coal carbonization is realized on all sides to be essential, and that therefore they have devoted considerable space to the exposition of these principles, and, furthermore, that they have considered the importance of the adequate demonstration of the large mass of research proceeding in various countries in this direction. They, moreover, have taken into their purview the interchange of ideas, experience and experimental results that have resulted from the many recent international conferences.

The work is divided into two main sections, the first being concerned with the underlying principles of carbonization, and the second with the technology of the subject. In the first section the main chapters are concerned with the various types of coal, the conversion of coal into coke, the testing of solid fuels in the laboratory, the thermal decomposition of coals, and the petrographic study and treatment of coal. In the second section are discussed the main types of low-temperature carbonization processes. This, as might be expected, is a very thorough exposition of up-to-date knowledge and practice, whilst the difficult process of selection has been carried out with commendable care and judgment.

In this section also is a concise treatment of the high temperature carbonization of coal.

The various by-products receive adequate attention. The technology and applications of ammonium sulphate, tar, creosote and benzole are briefly discussed, whilst attention is paid to the recent developments in hydrogenation.

This review will, of course, be read by petroleum technologists, who would be well advised to make themselves *au fait* with these developments in the technique of coal application, and in particular with the various means of achieving the fluidification of coal. In these days of economic nationalism each community is striving to render itself as far as may be independent of vital supplies derived from other and external sources. Fluid fuel is a specially valuable supply, and coal has learned from oil that fluidity is of paramount importance. Without fluid fuel war and commerce cease, and all our everyday life is immobilized. It is rather remarkable that we in our own industry, not faced with such an immense urge to create a new physical state for our commodity, should, to no inconsiderable extent, have been pioneers in the hydrogenation process and in the application of research generally.

A. E. DUNSTAN.

Books Received.

CANADA DEPT. OF MINES. BULL. 759. PETROLEUM FUELS IN CANADA, 1933. J. M. Casey. Pp. 12. 1935, Dept. of Mines, Ottawa. 10 cents.

Details are given of the deliveries of fuel oil, kerosine and petroleum coke in Canada during 1930 to 1933, together with information regarding the consumption for specific purposes.

SOCIETY OF AUTOMOTIVE ENGINEERS. S.A.E. HANDBOOK, 1935. Pp. xxx + 724. 1935, S.A.E., New York.

This handbook includes all the current standards and recommended practices adopted by the Society in reference to automobile parts. Details are given of the S.A.E. Viscosity Numbers for Crankcase Oil and Transmission and Rear-axle Lubricant.

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Class 200. Geology and Origin.

717. Outstanding Features of Petroleum Development in America. D. White. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 469–502.—An account of the history and development of the petroleum industry from the earliest times until the present day. For the period from the beginning of the nineteenth century attention is concentrated solely on America. S. E. C.

718. Anticlines between Hiawatha Gas-field and Baggs, Wyoming. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 537–543.—The Hiawatha gas-field lies partly in Colorado and partly in Wyoming. A folded and faulted zone separates the Washakie Basin from Sand Wash Basin, and this zone appears to correspond to an eastward extension of the structural trends in the Hiawatha field. Folding and faulting in post-Eocene times were followed by peneplanation and then renewed deposition, the Browns Park formation (Mioc.–Plioc.) being laid down. Subsequent earth movements caused further folding. A number of anticlines have been mapped eastwards from Hiawatha to Baggs along this zone, and those in the Wasatch (Eocene) or the overlying Green River formation are described. Two of these anticlines, the Powder Wash and the Baggs, have been drilled and gas has been obtained from the Wasatch. In addition, there are four others which may be expected to give gas. The remainder are very small, and are in some cases merely puckers in the beds dropped between two nearly parallel normal faults. S. E. C.

719. Greta Oil-field, Refugio County, Texas. R. A. Stamey, J. C. Montgomery, and H. D. Easton. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 544–559.—The Greta field lies 4 miles N.E. of Fox field and 12 miles S.W. of McFaddin and O'Connor fields. The structure is almost flat on top, but near the N.E., S.E., and S.W. edges the beds begin to dip away very quickly, and that accounts for closure in those directions. It is not yet known whether closure on the N.W. is due to lateral variation, the sand passing into shale, or to faulting. There is evidence of faulting parallel to the coast, and this faulting is seen in other fields along the coast, so that the authors are of the opinion that normal faulting occurs also in the N.W. edge of the Greta field. A number of suggestions have been put forward as to the origin of the structure—deltaic, deep-seated salt, sand-shoals, etc. The evidence appears to be most suggestive of a flat sand-shoal spread over a terrace on an anticlinal nose.

Production is from Miocene and Oligocene sands. The uppermost sands are in the Lagarto–Oakville series, are mainly gas sands, and vary in depth from 1700 to 2600 ft. The 3500-ft. sand in the Catahoula is productive only in the S.E. edge of the field. The main sand is in the Heterostegina zone, and, on account of the pore spaces in the sand often being filled with finer material, it is very irregular. Deeper production is also obtained from the Frio Formation. S. E. C.

720. Geology and Economic Significance of the Conroe Field. B. B. Zavoico. *World Petr.*, 1935, **6**, 144–157.—The geology, history and development of the Conroe field, Montgomery County, Texas, are reviewed. The field was discovered on Dec. 13, 1931, but its active development dated from June 5, 1932. Conroe has an indicated oil reserve of more than 500,000,000 brl., a quantity exceeded only by East Texas and Kettleman Hills. On Jan. 1, 1935, the field had yielded 41,376,299 brl. of oil. Data are given on drilling costs in the field and on the properties of the crude recovered. Drilling and production methods are outlined. W. W.

721. Possibility of Deep Production in North-western Pennsylvania. C. R. Fettke and S. H. Cathcart. *Oil & Gas J.*, 2.5.35, **33** (50), 19, 38; 9.5.35, **33** (51), 57, 59.—The regional structure of the northern Appalachian area is that of a geosyncline, the axis of which has a general N.E.–S.W. trend. Folding in the basin is relatively strong in the S.E. but gradually dies out north-westwards, and as the shore of Lake Erie is approached the beds dip at about 25 ft. in the mile with only slight warping.

In New York and Ohio, on the edge of the basin where the deep horizons of Pennsylvania are brought nearer to the surface, gas and a little oil have been found in the Trenton and the Medina (Clinton). The latter has also been reached in Pennsylvania, and is thought to underlie the whole of the western part of the State, and it is suggested that production may be possible from this formation under the southern edge of Lake Erie. Small production has also been obtained from the Oriskany, which is thinner and less continuous than the Medina. Other horizons between the Chimung and the Medina give a little production locally.

Between the Mississippian and the Pennsylvanian a large unconformity is present, and it is thought that the structures in the upper beds do not bear a very close relationship with those expressed at the surface; but, on the other hand, the beds below the unconformity do conform to a certain degree with the surface structures. The formations dip generally to the S.E., and the maximum thickness of the beds below the unconformity is in the northern part of the area, and it is suggested, having regard to the probable difference in the pre- and post-unconformity structures, that mapping should be carried out on the beds below the unconformity. Much of the area is covered with thick glacial drift, which makes reconnaissance difficult. Most of the work in the area has been carried out on the Corry Sandstone, which is about 20 ft. thick around Corry, but thins out rapidly to the east. The Meadville Limestones, which occur just above the Corry, have also been mapped. As a result of this work a number of anticlinal noses and terraces have been discovered around Crawford and Western Warren Counties, although these are not very definite. A probable structural nose or plunging anticline is indicated in the vicinity of Meadville and also one north of Garland. A small dome has also been mapped S.W. of Warren.

Samples from a number of deep wells in Western New York and N.W. Pennsylvania have been correlated, and the Devonian and Silurian systems have been accurately classified. It has been found that the shallow-producing sands of the south have either outcropped or petered out, although this fact does not entirely rule out the possibility of shallow production.

The beds thicken from N.W. to S.E. at varying rates, but the Oriskany never exceeds 27 ft. and has an average thickness of 15 ft. Metamorphism is associated with the late Palæozoic thrusting and folding movements which originated in the S.E.; and these conditions also increase with depth. It is thought that, in the south-eastern part of the State, production from the Oriskany is very unlikely owing to the lack of porosity. The chances increase north-westwards, for it has been proved that in some areas at least, the Oriskany is sufficiently porous to act as a reservoir. At the same time it is pointed out that, owing to the lack of thickness of this formation, the yield per acre will not be large, even if suitable structures are discovered. As metamorphism increases with depth, it is unlikely that the Medina will produce oil in Pennsylvania, although a little gas might be obtained in the N.W.

Other horizons have been tested in the area, and gas was encountered in the Salina group at a depth of 7428 ft. in Westmoreland County. The Lockport Dolomite produced a little oil and gas in Crawford County at a depth of just over 4000 ft. The latter formation is thought to be the more promising of the two. J. A. G.

722. Age and Correlation of Pennsylvanian Surface Formations, and of Oil and Gas Sands of Muskogee Co., Oklahoma. C. W. Wilson. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 503–520.—The Atoka, Hartshorne, McAlester, and Savanna formations and a part of the Boggy shale were mapped from the type localities near McAlester northwards to the Arkansas river, Muskogee Co. This permitted the Pennsylvanian formations of S.E. Oklahoma to be correlated with those of N.E. Oklahoma. It is shown that the Winslow formation of Muskogee Co. corresponds to the formations mentioned above. It was also found possible to determine the true ages of the various oil and gas sands. The Dutcher group of sands is equivalent to a number of sands in the Atoka formation. The "lime marker" above the Dutcher sands is partly the equivalent of the Webber Falls sandstone (Atoka), whilst the Booch sand represents

the Warner, Cameron and Lequire sandstones (McAlester shale). The Bartlesville sand has been correlated with the Bluejacket sandstone member of the Cherokee shale on the north side of the Arkansas river.

There are at present ten oil and gas fields in Muskogee Co. These may be divided into two structural groups. The first group is related to small, local anticlines of no regional significance, whilst the second group is developed along monoclinal folds associated with large, normal faults. S. E. C.

723. What is the Vaqueros Formation of California, and is it Oligocene? H. G. Schenck. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 521–536.—The Vaqueros formation of the Coastal Ranges of California has never been satisfactorily defined, even in its type locality. The conflicting statements of various workers are quoted and a suggestion is made that since many sands, etc., equivalent in time to some part of the type Vaqueros are now being mapped, they should be placed in a "Vaqueros group." The question of age is also examined. Even assuming the Vaqueros to comprise the Turritella inezana zone, the author disputes the Miocene age previously assigned to it. From a consideration of the evidence and of the various opinions concerning the definition of Oligocene and Miocene it is concluded—assuming the Aquitanian to be Upper Oligocene—that the Turritella inezana zone is wholly or in part Oligocene in age. S. E. C.

724. The Gillis-English Bayou Area an Interesting Geological Study. C. Leyendecker. *Oil Weekly*, 27.5.35, **77** (11), 62–65.—The English Bayou field lies 1 mile south of the Gillis field, and is separated from the latter by a large fault. It is on part of a large salt ridge which includes the Gillis pool, Iowa, Welsh, Roanoke and possibly Lockport fields. These fields represent elevations on the ridge. Geophysical work has shown a major fault on the southern half of the ridge and radial faults in several areas. The two main faults have acted as effective oil-traps, and the block between them is dropped down. There is little or no evidence of Pliocene or Miocene production. Both fields produce oil from the Marginula zone, and a number of prolific gas sands have been encountered. G. D. H.

725. Geology and Exploration in North-Eastern Mexico. J. L. Tatum. *Oil Weekly*, 10.6.35, **77** (13), 35–40.—The lower Cretaceous of Texas changes rapidly at the International boundary from a comparatively thin heterogeneous section to a thick lime section varying in thickness, and in the age of its upper and lower limits. The upper part is the main productive horizon in the Tampico field—the Tamasopa and Tamaulipas limestones. The beds equivalent to the Eagleford and lower Austin of Texas have hard flaggy limestones interbedded with dark and sometimes petroliferous shales. These are the San Felipe, and are productive at Panuco. Above the middle Austin is a great shale body, at times sandy, and divided into the Papagayos (lower) and Velasco. In places it is younger than any Cretaceous beds in Texas.

Eocene beds also tend to be thicker in North-east Mexico than in Texas, *i.e.* the Midway is 3000–3500 ft., and consists of clays with a lower sandy phase. The 2500 ft. of Wilcox (Indio) beds resemble those of South-west Texas, and similarly for the Carrizo. The Mount Selman sand-shale is highly fossiliferous in parts, and the Cook Mountain formation of this zone is a dark clay, previously mapped by the author as "Yegua." His former "Fayette" now becomes the Yegua.

Lithologically the Jackson is not easily divisible as in Texas, but there are clear faunal zones. At Tamaulipas the upper Jackson is similar to that of South Texas, and in Nueva Leon it is a series of greenish-grey bentonitic clays with a few thin flaggy sandstones. A supposed Oligocene scarp is present, although the fossils are said to be more nearly akin to the Jackson. The Gueydan includes these beds and the beds of Vicksburg age, the lower section being marine and thickening to the south. Most geologists take a large gravel lens as the upper limit of this series, but the author puts the lens at the base of his Oakville (upper Oligocene ?) formation. The Oakville contains green and red clays, reworked volcanic ash, coarse sand and lenticles of chert gravel.

A series of caliche-covered sands and light coloured clays with thin gravel beds have a similar appearance to the Reynosa of Duval County, which grade southwards into the marine San Fernando beds of Dumble, formerly considered as upper Oligocene, but now placed as mid-Miocene.

Some thirty-nine wells have been drilled in Northern Mexico, from west of Del Rio, Texas, to south of the Samfordyce field. Six of these yield gas from the top of the Mount Selman, and a few have shown oil in the Jackson and the marine Vicksburg.
G. D. H.

726. Prospects of Oil in Great Britain. V. C. Illing. *Petr. Times*, 1935, **33**, 655–657.—The eleven wells drilled by the Government during the war period can scarcely be said to exhaust the possibilities of a country of the size and geological complexity of Great Britain. It can be taken for granted that adequate oil source rocks have been formed at several periods in the geological record of these islands, *e.g.* the middle Carboniferous and upper Jurassic, but the folding, faulting and denudation to which these rocks have been subjected since their deposition have been so severe that, over the long intervening periods, the oil has had all too many opportunities to escape, giving little hope of its preservation in the large quantities necessary for a successful oil-field. Examination of the saline waters found in the Government wells supports these conclusions, for the salt content is low and similar to that of the shallow waters of oil-fields where water circulation is causing dispersal of the fluids. Yet these waters are from wells 2000–4000 ft. deep. Hence it is clear that the structures tested are not water-tight, and dispersal has occurred.

In Eastern Yorkshire and Lincolnshire it is reasonable to expect the presence of gently folded Carboniferous, with a suitable sealing cover of Mesozoic rocks which could prevent escape of any oil or gas in post-Permian times. Such areas are more hopeful, but little is known of the Palæozoic structures there. The Mesozoic rocks of Eastern and Southern England are linked with those of the Continent which have the Hanover basin oil-fields in their midst. The Lias, Kimmeridge and Oxford clays, and part of the lower Cretaceous, may be considered as typical oil source rocks, and do contain oil or produce a little gas as at Heathfield, Sussex. In consequence of the presence of these formations, structures in the Weald have been tested, but with negligible success. The apparent lack of oil in commercial quantities may be due to early Cretaceous unconformities or to leakage after the Wealden folding. Small pools are possible in this belt, but it is unlikely that large production will be obtained.
G. D. H.

727. Sub-structure of the Vienna Oil-field. L. Waagen. *Bohrt. Ztg.*, 1935 (4), 98; (5) 128.—A geological discussion on the sub-structure of the Vienna oil-field. L. S.

728. Oil Possibilities in the West Kimberleys of Australia. A. Wade. *Petr. Times*, 1935, **33**, 588.—The most likely strata in the region, both as sources and having chances of accumulation and preservation of oil, are the Permo-Carboniferous beds above the glacial group. Organic matter, plant and animal, has been entombed, and there are considerable thicknesses of clays and shales suitable for cap-rocks. Whilst these rocks have rarely been strongly folded in this area, they have been deeply eroded, thereby reducing the chances of the preservation of oil. In areas such as those around the Erskine range and the Edgars, younger beds overlie these strata and the possibilities seem better.

Borings at Price's Creek in the Poole Range, and at Mount Wynne have given heavy residual petroleums as well as light members, showing that oil has been formed in the Permo-Carboniferous beds. It is recommended that the investigation should be continued, and more attention given to the areas where a low degree of folding is indicated, and which have not yet been closely examined. G. D. H.

729. Magnetic Prospecting. W. P. Jenny. *Oil & Gas J.*, 25.4.35, **33** (49), 33.—Many misinterpretations have resulted from the belief that the magnetic effect is almost entirely due to tectonic dislocations of the " basement " rocks underlying the oil areas. It is known now that sufficient difference in the magnetic susceptibility exists within the sedimentary columns to produce magnetic anomalies above structures of commercial interest.

It is possible to discover and trace thickening and thinning of beds magnetically.

The author cites a few practical examples of magnetic surveys to demonstrate the possibilities and economical value of this method. L. V. W. C.

Class 300. Development and Production.

730. Pressure Drilling. S. S. Parker. *Oil Weekly*, 15.4.24, **77** (5), 23.—It is possible to divide sub-surface pressures into abnormal, normal and sub-normal.

Abnormal pressures are those encountered in any well bore in which it is necessary to maintain a hydrostatic pressure in excess of that which may be normally maintained by the use of a circulating fluid made from natural shales or clays only. In most cases slightly abnormal pressures may be most efficiently controlled by changing the character of the fluid column.

The pressures encountered at depths of 8200 ft. and lower levels in the Big Lake field are normal, and pressure-drilling equipment has been used extensively. By this method the drilling fluid is prevented from entering the formation and so injuring the productive ability of the well. It is also possible to constantly measure the production of oil and gas with continued penetration.

Pressure-drilling equipment has been used for sub-normal pressures in the Big Lake field. L. V. W. C.

731. Multiple Drilling under One Location. B. Mills. *Oil Weekly*, 29.4.35, **77** (7), 27.—The Barnsdale Oil Company of California has successfully completed three producers from one location, and has demonstrated the value of multiple drilling operations for positions where foundations are a problem. A large saving in cost was effected by this operation.

In starting the first well a wooden frame was used to hold the string of 18¾-in. pipe against the conductor. A length of this string was welded together and drawn 2 ft. into the shale against the side of the 49-in. conductor pipe. This gave an inclination of 2½ degrees. There was no necessity to move the crown block or draw-works from their normal positions, but the table was moved 2 ft. nearer the draw-works. After drilling 178 ft. the rotary table was moved back to its normal position and the hole drilled to 500 ft., at which depth a 13¾-in. string was cemented.

The 18¾-in. casing was then stripped off and the 13¾-in. casing pulled over against the 49-in. conductor, and the smaller string was then cemented up to the shoe of the conductor.

The hole was then deepened to the top of the oil horizon by normal methods, and a temporary christmas tree was provided for testing the well.

In starting the second well the 18¾-in. pipe was driven 3 ft. into shale against one side of the conductor. The drilling then proceeded as previously except that the crown block was moved 6/10 ft. towards the draw-works.

For the third hole a 4-in. offset was placed in the bottom 13 ft. of the 18¾-in. string, which was then driven 3 ft. into the shale with the bottom against the side of the 49-in. conductor. The crown block and rotary table were moved 6/10 ft. towards the draw-works and 9 in. to the right from the derrick centre line. The well was then completed as previously.

By this method the holes at the surface form an isosceles triangle, each well being 2 ft. from the next. L. V. W. C.

732. Directional Drilling. W. A. Sawdon. *Petr. Eng.*, April, 1935, **6** (7), 78.—Directional drilling indicates not only directing the hole to some point not immediately below the starting point, but also the negative action of keeping the hole vertical.

Direction is controlled both with and without deflecting tools. The whipstock and knuckle joint have their definite applications, but if the well is to be kept vertical, only proper drilling control should be necessary, with due attention to the weight carried on the bit and to the speed of rotation.

Periodic surveys are indispensable, but their frequency depends on too many conditions to provide a rule.

The drilling of more than one well from one location will show an obvious saving in expense in the construction of foundations.

The legal aspects of deflected wells is receiving attention. L. V. W. C.

733. Revolutionary Development in Fishing Practice. Anon. *World Petr.*, 1935, **6**, 243–244.—In coping with the larger problems involved in the constant increase in the depth to which producers have found it practicable to go for oil, one problem which has remained a stubborn menace in all territories where a soft formation is

encountered immediately below a hard one is the recovery of lost pipe. This article describes, with the aid of illustrations, a wash-over wall-hook which locates the fish and brings it to grips with the equipment selected as best fitted to extract it from the hole in one and the same operation. With this new tool the washing-over process can begin immediately upon the location of the fish. W. W.

734. Collapsible-blade Bit for Drilling Through Heaving Shale. Anon. *Petr. Eng.*, April 1935, **6** (7), 64.—In an effort to reduce blow-outs and the difficulties caused by heaving shale, a collapsible-blade bit has been developed.

This bit is so designed that the blades can be replaced without removing the drill pipe. The blades are dropped into position in the collapsed form, and are held locked in the drilling position so that they cannot be collapsed from any external pressure.

The blades are removed by running a specially designed overshot on a wire line.

L. V. W. C.

735. Pressure-operated Blow-out Preventer of Improved Design. K. C. Sclater. *Petr. Eng.*, April 1935, **6** (7), 62.—A new and improved blow-out preventer has recently been tried out in the Harris County field, Texas.

This blow-out preventer, of which a full description is given, is of the pressure-operated type. L. V. W. C.

736. Truck-mounted Portable Rotary Units. J. A. Niles. *Oil & Gas J.*, 9.5.35, **33** (51), 43.—Proration has made the large diameter hole both unnecessary and costly. The result has been to drill the smallest possible hole commensurate with the allowed production.

In order to permit holes to be drilled to depths up to 4000 ft. for completion with 6-in. casing, the Stanolind Oil and Gas Co. have developed a portable truck-mounted rotary drilling unit.

Drilling is as fast as with bulkier equipment, and there is a saving of at least 80% in the rigging-up time.

Light weight is the main feature of the outfit, the whole rig weighing only about 42,000 lb. It is mounted on a four-wheel-drive 10-ton capacity truck, and consists of independent motor, rotary draw-works, mud pump, electric lighting generator and heavy-duty gear-transmission box.

A full description of the unit is given. L. V. W. C.

737. Drill Stem. H. W. Fletcher. *Oil Weekly*, 20.5.35, **77** (10), 33.—Low-carbon lap-welded drill stem was used in the early rotary drilled wells, but with increasing loads and depths, a medium carbon seamless drill pipe with heavy upset and special thread form, together with heat-treated alloy joints, was introduced.

The apparently simple drill-stem structure contains complicated design problems not susceptible of exact mathematical solution. Fatigue, possibly accelerated by corrosion, is the predominating type of failure, and the principal destructive factor is probably vibration, both torsional and transverse.

No marked reduction of failures through metallurgical improvement is at present likely, although some advantage may be secured through changes of design at the expense of some other less important factor.

Greater care in the use of drill stems will assist in reducing the problems encountered.

L. V. W. C.

738. Drilling Barges. C. I. McBride. *Oil Weekly*, 29.4.35, **77** (7), 19.—The Texas Company expects to realize a net saving of $600,000 during the year 1935 with the fleet of seven drilling barges which are now operating in the Louisiana Gulf Coast.

Certain decided advantages are shown by the type of construction followed. Tides, wind and waves do not affect the barges which are sunk solidly on lake bottom. With the submerged barges the 136-ft. derricks remain truly vertical during all drilling operations and unusual stability is provided by the submergences.

The strength requirements of these drilling barges were calculated for extreme conditions.

A detailed description of the various items which comprise the units is given.

L. V. W. C.

739. Compressed Air for Drilling Power. B. Mills. *Oil Weekly*, 6.5.35, **77** (8), 29.—The Barnsdall Oil Company is using compressed air for drilling power in the Elwood, California, with satisfactory results.

Ordinary steam equipment is being used on the drilling rig, and a battery of gas compressors each rated at 185 h.p. and giving three stages of compression is used in conjunction.

Special intake valves are installed on the suction side of the primary stage, and nine compressors which have been blocked off and converted into air compressors make a separate unit. By a new manifolding arrangement possibility of gas contamination is eliminated.

Special regulators are fitted on to the compressors so that air may be admitted to the cylinders as it is needed to maintain the line pressure to the drilling well. Air is delivered to the line at a pressure of 175 lb.

The temperature of the air to be used is raised to a point that permits full use of the drilling engine and mud pumps by means of a specially designed air heater.

L. V. W. C.

740. Many Hook-up Innovations are Installed in Gulf Coast Rig. C. Leyendecker. *Oil Weekly*, 6.5.35, **77** (8), 33.—Several innovations in modern rig design and hook-up are included on one of the most modernly equipped rigs in operation at Pierce Junction, Texas. One of the interesting features is the application of stationary power-plant principles to an oil-field rig-power plant. Among other interesting features are the installation of a centralized rig greasing system, abundant use of specially designed steel skid foundations for machinery and simplified piping connections.

L. V. W. C.

741. Methods of Determining how much of a Frozen or Cemented Column of Pipe is Free. J. T. Hayward. *Oil Weekly*, 20.5.35, **77** (10), 19.—Some method of finding out where drill pipe or casing is frozen is desirable, so that it can be decided whether to make further efforts to free it or to cut or shoot it off and sidetrack.

In addition, it is becoming of increasing importance, when casing is cemented, to know how far up the column the cement has actually reached. It may be that too much cement has been used, resulting in unnecessary expenditure on cement, excessive back pressure on the producing formation and the loss of pipe if and when the well is abandoned.

The author gives three methods for determining where the pipe is stuck, two of these having been worked out and used with success in practice. L. V. W. C.

742. Drill Pipe Stresses and Failures. H. W. Graham. *World Petr.*, 1935, **6**, 223-234.—Deals with the development of drill-pipe material from the early welded low-carbon pipe to the present-day high tensile seamless material, and the structural problems that have been overcome in developing drill pipe to stand the very high torsion and compression stresses at 10,000 ft. depth of hole. In considering the stresses occasioned by a stalled bit, analysis of the factors entering into such stresses indicates that the reason for twist-off failures occurring mostly in the bottom lengths of drill pipe lies in the fact that the gross force exerted is applied first at the bottom-most length, and decreases considerably as it is transmitted up the string, with consequently less likelihood of failure in the top joints. The magnitude of the stress imposed by sudden stoppage of the bit is a function of the distance between the longitudinal axis of the drill pipe and the mean circumference or radius of gyration of the tube. Any increase in diameter of the pipe rapidly increases the stress. With increased drilling depth the drill-pipe string is lengthened and the total kinetic energy of the "fly-wheel" system of the revolving pipe is correspondingly increased. The rate at which this energy is built up when various sizes and weights of drill pipe are stalled in one-twentieth of a revolution from a speed of 75 r.p.m. is illustrated by means of a chart. The increase of stress is shown to be directly proportional to the increase of depth of hole.

In analysing the character and extent of the stresses entering into drill-pipe service, indication is that static stresses are relatively unimportant in causing failure of the pipe. Dynamic stresses of the torsional impact type are shown to be capable of causing failure depending on conditions of service. The following conditions are shown to be major factors in service failures: (1) Abruptness of stalling, (2) outside diameter of drill pipe, (3) wall thickness or weight of drill pipe, (4) depth of hole, (5) r.p.m. of drill pipe.

W. W.

743. Bottom-hole Water Shut Off and Upper Horizon Tested by Deflected Drilling. A. Buchanan. *Oil Weekly*, 29.4.35, **77** (7), 32.—Controlled drilling is being employed to record possible producing zones passed at shallower depths, and also provides a plan for shutting off bottom-hole water.

In the discovery well in the Sinton field nothing was shown at a depth of 6602 ft., although a test had logged an interesting section at 5400 ft. When an electric formation-testing device was run, a high porosity was indicated at the 5400-ft. level.

A removable whipstock was run in this case after plugging back to 5100 ft., and the new hole was drilled to the desired depth and a producer resulted.

Where a well showed considerable water in the production, the well was plugged back with cement, and a whipstock cemented at 147 ft. from bottom. The casing was milled out at this point and the hole redrilled several feet off the known water level in the hole. A smaller string was set and cemented, and on completion the well flowed pipe-line oil. L. V. W. C.

744. Cementing the World's Deepest Casing. C. P. Parsons. *World Petr.*, 1935, **6**, 220–222.—The setting of 10,300 ft. of 7·5/8 in. O.D. 34 lb., Grade D, casing to A.P.I. Specification, at McElvoy No. 103 in the West Texas area, was successful in every detail. The total weight of the 342 joints of casing was 350,000 lb. Crown block and travelling block were strung with 10 lines 1·1/8 in dia., and the rotary table was removed and a special steel foundation built to support the casing spider. A slip type elevator was used. The maximum sag of the derrick during the cementing operation was less than an inch. The casing was run in 19 hours, and 1000 sacks of plain Portland cement, mixed with water chilled to 40° F., were placed in 1 hour 11 minutes. The cement was allowed to set for several days, and then the floats and 70 ft. of cement that was intentionally left in the casing were drilled out without any difficulty. Drilling is continuing, and the present depth of the well (April 1st) is 12,174 ft. W. W.

745. Gel-Cement. W. A. Sawdon. *Petr. Eng.*, April 1935, **6** (7), 29.—The best possible manner of closing fissures and cavities and of confining formations that tend to heave into the hole is by the use of cement. The difficulty will often arise, however, of making a pumpable mixture of cement and water stay where it will be effective. To overcome this difficulty a gel-cement can be used, and this can be made by the addition of a specially treated bentonite mixed with water before making the cement slurry. The use of a material, consisting of gel-forming colloidal particles, in the cement slurry produces an angle of repose of about 45 degrees, as against 5 degrees for neat cement.

Gel-cement was first used in the Barbers Hill field, where the drilling into the producing sand is very complicated. The cap rock in this field was found to be badly fissured and the drilling returns were generally lost, and the fluid level in the well stood at about one-third the height of the hole. It was found that the only satisfactory method was to fill up the cavities with the slurry before any benefit could be derived from its use.

The strength of cement varies almost entirely with the water–cement ratio, but the use of this high-quality bentonite seems to have had little effect on the strength up to a percentage as great as 5 or 6% by weight.

With any given water–cement ratio the more gel used the greater will be the consistency and the angle of repose. L. V. W. C.

746. Cementing Methods for Excluding Water from Producing Wells. R. E. Watson. *Oil Weekly*, 20.5.35, **77** (10), 25.—This paper explains three methods which have been developed and utilized successfully for plugging off water.

One method consists of plugging off bottom water in producing wells by means of an especially designed tubing plug and placing the cement under pressure.

The second method relates to under-reaming and cementing an oil string to shut off water occurring only a few feet above the oil-producing horizon.

The third method utilizes a cement slurry under pressure after the pressure necessary to pump water has been ascertained. L. V. W. C.

747. Control of Drilling Mud in Deep Wells. G. L. Ratcliffe. *World Petr.*, 1935, **6**, 240–243.—In deep drilling it is advisable to be sure that the mud contains an adequate percentage of gel-forming colloidal material, either by proper selection of the clay base

or by the addition of bentonite. It is also advisable to keep the unit weight of the mud as low as is consistent with safety, in order to reduce the differential pressures at great depths as much as possible. Careful continuous checking and control of the mud are most important. The author advocates the keeping of hourly records of the weight, viscosity, temperature and gel-strength of the mud, and the devising and installing of a system which will enable additional clay, colloidal matter, weight material or chemicals to be added promptly when necessary to change the characteristics of the mud. W. W.

748. Conservation of Colloidal Material in Native Drilling Muds. M. I. Halbouty. *Petr. Eng.*, April 1935, **6** (7), 60.—One of the most important characteristics that a mud must maintain is that of colloidal strength, and a mud with a high percentage of colloids can be handled at much less cost and with greater ease than a mud with a low percentage of colloids.

Under ordinary drilling conditions colloids are produced from the plastic and gummy shales by the action of free water, which acts as a dispersion medium in reacting with the colloidal materials to form the native colloids. The mud made primarily from the colloids derived from the formation should be best adapted for further penetration of that particular formation, since the mud would have the same chemical characteristics as the shale body, and no detrimental reaction should take place between the mud and the shale.

The author explains a method whereby the mud being formed during drilling is maintained in its most efficient form. The cubic feet of hole being drilled per hour, together with the amount of cuttings coming out of the hole per hour, are determined, and from the difference between the two it is concluded that the rest of the cuttings are being made into mud, less about 2% for cuttings adhering to the walls of the well.

A certain amount of water is then added to the mud to act as the dispersion medium for the material that has a tendency to go into suspension as colloidal material. The colloids are naturally active, and the pH value can be maintained and peptized higher by the addition of chemicals from time to time.

Chemicals should be added to the mud only when necessary, and the native colloids should be used economically and practically in the treatment of rotary muds. L. V. W. C.

749. Handling High-Pressure Wells on the Gulf Coast. K. C. Sclater. *Petr. Eng.*, April 1935, **6** (7), 54.—More than ordinary care is needed in the drilling-in of high-pressure wells in the Gulf Coast area on account of the presence of relatively shallow sands carrying high-pressure gas and of the presence of heaving shales.

Mishaps are becoming much less frequent on account of the rapid strides made in developing methods and means to control the wells.

Pressure-drilling equipment and flush-jointed drill pipe have been used with success, and mud weighing 13 lb./gall. has been used.

In ordinary circumstances, in the Gulf Coast two strings of casing are required, but in the blow-out areas it is common practice to set three strings. When heaving shale is present, the mud fluid becomes important, and one or more blow-out preventers of the core or bowl type are used.

When drilling through heaving shale, the chemical treatment of the drilling mud and care in the handling of the mechanical equipment are necessary. The weight of the mud is of importance when drilling through heaving shale, the pressure of the mud being a function of the time it takes to build up a mud sheath on the wall of the well.

When drilling with salt-laden drilling mud certain precautions are necessary, particularly when Aquagel is to be added. L. V. W. C.

750. Deepest Cable-tool Well. Anon. *World Petr.*, 1935, **6**, 235.—A short article directing attention to the fact that the United Fuel Gas Co.'s Well No. 4053, at Frozen Camp, W. Va., spudded in early in 1930, was drilled to 9270 ft. by the cable-tool method. The well was abandoned when found to be unproductive at this depth. W. W.

751. Problems in Exploitation of Deep Deposits. L. C. Uren. *World Petr.*, 1935, **6**, 208–214.—A few of the physical problems with which the engineer has to deal in the exploitation of deep-seated oil deposits are briefly discussed. Some of them relate

to the drilling of deep wells, others attach to the production or operating phase. In order to deal successfully with the many technical problems presented, the oil-producing industry must include in its rank and file a greater percentage of engineering personnel. Engineering technique as well as practical experience is required to drill below 10,000 ft. and meet successfully the problems set forth. W. W.

752. **Chitorani No. 1, Rumania's Deepest Well.** O. V. Erbiceanu. *World Petr.*, 1935, **6**, 215–219.—A brief account of the drilling of this well, which has been sunk to a depth of 11,092 ft., together with a descriptive outline of the equipment employed. The well is located 6¼ miles N.E. of Ploesti and ¾ mile N. of the main highway Ploesti–Buzau. The objective was to test the anticline Valea Calugareasca–Chitorani. This well has proved that the lower Pliocene formations are to be found at a very great depth, even in the proximity of the axis of the anticline. From the considerable dip disclosed by the cores it is supposed that the formations sink rapidly towards the south. Production tests subsequently made have shown that the Meotian sands at this point do not contain oil on the southern flank of the Chitorani anticline. Rigging up of Chitorani No. 2 is now in progress with the intention of exploring the northern flank of the anticline. W. W.

753. **Open-hole-diameter Recording Calipers.** R. C. Beckstrom. *Oil Weekly*, 27.5.35, **77** (11), 19.—Recording calipers enable accurate location and measurement of cavities and constrictions of oil wells to be made. Such measurements assist in determining the amount of cement to be used in cementing and plugging back jobs, locate favourable locations for setting casing or packers and assist materially in a number of other jobs.

The instrument referred to has four expanding arms each with a radius of 4 ft. 2½ in. The overall length of the tool is 9 ft., the lower six consisting of a 5-in. pipe in which the arms are locked as it descends the hole. The recording instruments are located in the upper part.

The arms operate a ratchet which raises and lowers the recording stylus against a chart on the cylinder, each arm registering its own radius. Thus the position and extent of the cavity are determined.

The calipers are raised and lowered by a wire line which passes through a measuring device to give the exact depth of all the readings on the chart. L. V. W. C.

754. **Evolution in Pumping Practice.** W. G. Taylor. *World Petr.*, 1935, **6**, 236–239.—Economic necessity has caused more attention to cost factors in pumping that were formerly overlooked, resulting in greater efficiency. Slow-motion pumping has developed from an experiment to a recognized new practice. Reduction in pumping speed required at the rig has been met by various combination of gears, sprockets and chains, but the real solution to the problem is the gear-motor. This is a motor combined with a built-in reduction gear, single or double, and is a highly compact and efficient unit which can be connected directly to the crankshaft by chain drive. Triple-rated electric motors have been designed to suit the variety of pumping loads, including provision for operating a production hoist. These motors are principally of the squirrel-cage type, and the windings are so tapped that connections for any one of the three ratings are made in a moment by throwing or plugging-in one of three switches. The motor runs at practically the same speed on all three ratings. These ratings have been standardized in the ratio of 10, 7 and 4—for example, 25/17/10 h.p.—the highest rating always being a normally standard one. Advantage of a triple-rated motor over one with a single rating lies in the better efficiency and power factor which the lower ratings give on light loads. (This article includes curves showing the relative efficiencies and power factors on a triple-rated motor with ratings of 25, 17 and 10 h.p.)

The use of electric time switches to start and stop automatically the motors operating part-time pumpers, so that they will run on a predetermined schedule to stagger the operation, produces a lower and more uniform power demand.

The use of outdoor equipment of all kinds, including motors and control, eliminates motor houses, thus reducing the investment, maintenance and loss in salvaging material. W. W.

755. **Kansas Stripped Area Economy Need Reflected by Pumping Installations.** C. E. Morris. *Oil Weekly*, 27.5.35, **77** (11), 22.—Economy is the major interest to producers

in the N.E. Kansas Stripper Area. The majority of the wells here are kept alive by application of artificial methods of recovery. It has been found that at least three times as much oil can be recovered by artificial methods as would have been recovered by only the natural method of pumping.

One of the outstanding examples of economy is in the use of rod-line equipment and oil-well pumping jacks. Concrete jack-blocks for foundations are far the most economical, as no further replacement is necessary during the life of the well.

Similar foundations have been found economical for jack legs and braces, rod-line swings and rod-line turntables. L. V. W. C.

756. Geared Pumping Units for Reciprocating Well Pumps. L. A. Little. *Oil Weekly*, 6.5.35, **77** (8), 39.—The two main classes of prime movers used in the production of oil are I.C. engines and electric motors. The I.C. engines are operated at speeds varying from 180 to 300 r.p.m. in the case of single- and twin-cylinder gas engines of slow speed, and 600–1200 r.p.m. for multi-cylinder gas engines, oil engines and diesel engines. Electric motors operate at speeds of from 600 to 1800 r.p.m.

Pumping wells are usually run between 10 and 30 strokes per minute, and with the advent of the electric motor it became necessary to use larger reducers of speed between the prime mover and the walking beam.

This necessity resulted in a demand for geared reduction units, which in turn resulted in an appreciable saving in the power bill.

Simplicity of design and operation is essential in production machinery, and the majority of geared units of recent design are therefore single reduction gears with V-belts driven from a sheave on the prime mover to the sheave on the pinion shaft of the unit. The V-belts offer a cushion in the mechanism which absorbs and furnishes desired speed flexibility.

The average single-reduction-geared unit employs a gear ratio of about 10 to 1, and when slower-speed prime movers such as a single-cylinder gas engine are used, a V-belt ratio of approximately 1 to 1 is employed. L. V. W. C.

757. Diesel and Gas Individual Well-Pumping Units and their Operation. G. McConnell. *Oil & Gas J.*, 9.5.35, **33** (51), 33.—Field engines can be divided into two general groups, (1) those for dual operation purposes, and (2) those for a single purpose. The former group require a wide range of power and speed, whilst the second group can be smaller, and may employ most economically the four-cycle principle.

For individual well-pumping units high-speed oil and gas engines are becoming more and more applicable. To secure the lowest power cost, single-purpose pumping units offer the best opportunity. L. V. W. C.

758. Central Pneumatic Power Plants Adapted to Pumping Problems. P. D. Cornelius. *Oil & Gas J.*, 9.5.35, **33** (51), 48.—The pneumatic pumping system is an improved method of actuating sucker-rod pumps by the direct application of the energy of a compressible fluid to the polished rod through the medium of a specially designed cylinder directly above the well, and connected to the upper end of the rod string. The system consists of a single-stage air compressor as the source of power, with its driving unit, pipe-lines for conducting the compressed fluid to and from the well, preheaters at the wells and control valves for maintaining the proper operating pressures.

A complete description of the operation of the pneumatic pumping system is given, together with load-velocity and load-stroke diagrams. L. V. W. C.

759. Central Mechanical Power. A. Allen. *Oil & Gas J.*, 9.5.35, **33** (51), 38.—The mechanical power set-up is one of the oldest means of producing a well, but considerable study has been given to this subject, in order to improve the general application of the power, rod-line and pumping-jack principle.

Central mechanical powers may be divided into two general classes: (1) central lease power, and (2) back side cranks. The author deals with the former class.

Charts are given for determining maximum daily total fluid obtainable with pumping jack, for calculating all the factors required for a proposed central power installation, for obtaining the total cost of surface-pumping equipment and for the unrecoverable cost items of surface-pumping equipment. L. V. W. C.

760. Critical Pumping Speeds Reduce Lifting Costs. J. C. Albright. *Oil Weekly*, 6.5.35, **77** (8), 21.—It has been found that the critical pumping speed is not the same for each individual case. There is a critical speed which will produce the maximum amount of oil from a producing zone, but that speed will be governed by a number of variables. The depth and the amount of water to be lifted with the oil must be considered, and if gas is produced freely with the oil, some wells must be pumped at a greater rate of speed to eliminate gas lock. Slow pumping assists in minimizing sand troubles. L. V. W. C.

761. Running Packers in Wells under High Pressures. H. C. Otis. *Petr. Eng.*, April 1935, **6** (7), 42.—Special equipment has been developed for running packers under pressure without the danger of the packer being prematurely set and blown from the well.

The scrubbers employed are the same as those used when running or pulling tubing alone under pressure, and the control heads are the customary ram type used in ordinary tubing pressure operations.

Wells with high bottom-hole pressure present a problem in the design of the packers themselves as well as in the design of the tubing head. A decline in the pressure above the packer, due to a defective string of casing, may be of such an amount that the full weight of tubing will no longer be sufficient to hold the packer expanded against bottom-hole pressure. In one instance of this sort water was pumped in daily to keep the pressure up.

Running a hook-wall packer upside down will in some cases meet the reduced pressure situation, since the slips will prevent upward movement.

Packers will not, under all conditions, effect a complete and permanent seal, but recent improvements in their construction and operation have certainly increased their usefulness. L. V. W. C.

762. Recementing and Repair Work in Wells. W. A. Sawdon. *Petr. Eng.*, May 1935, **6** (8), 59.—Recementing jobs and repair of wells with cement are generally more difficult than the original cementing operation. Obstacles may be present that require the use of special equipment.

It is usually impossible in most repair work to obtain circulation behind the casing. In addition, the exact amount of cement required cannot always be accurately estimated.

Cement retainers and casing-bridge plugs are in common use in recementing and plugging-back operations. In repair work the use of these appliances cannot be blindly recommended, and the particular conditions existing will determine whether they should be used or not L. V. W. C.

763. Paraffin Production Problems. C. E. Reistle, Jr. *Oil Weekly*, 29.4.35, **77** (7), 17.—In combating paraffin problems a careful study of the situation should be made to determine what practical and economical modifications can be made in the production practice to prevent the separation of paraffin from the oil and its deposition in the flow string, flow lines and tank batteries. In addition, the methods that should be employed to handle or remove the paraffin that may accumulate after the proper steps have been taken to prevent its deposition should be determined. Lower handling costs will result if a proper balance is struck between good production practices for prevention and the application of effective methods of removing the paraffin.
L. V. W. C.

764. Coring to Obtain Formation Data Aids Acidation Work. E. S. Post. *Oil Weekly*, 22.4.35, **77** (6), 32.—Three types of producing formations have been successfully treated with acid, but no method can apparently be classified as the most perfect way of applying acid.

It can be said, however, that with adequate data on the producing horizons the best type of solution to be used and the manner of application to obtain the best results can be determined. Coring the formations to be treated is therefore vital. From the cores it is possible to make up a charge of acid to combat the various elements in the formation. L. V. W. C.

765. Limestone Reservoir Rocks of Kansas React Favourably to Acid Treatment. C. E. Clason and J. G. Staudt. *Oil & Gas J.*, 25.4.35, **33** (49), 53.—Acid is used

primarily to increase the porosity and permeability of the producing horizon, and so increase the movement of oil and gas through the formation and into the hole.

Various methods of acidizing have been used in Kansas, since a treatment must take into account the individual log and record in order to give the well the best possible chance to respond.

The Carr method is used in a majority of cases. This consists of filling the hole with oil and then introducing the acid down the tubing as the oil is bled off from the casing head. This bleeding is continued until the acid has reached bottom and risen in the hole to the top of the producing formation. If necessary, pressure is applied to the fluid in the tubing to force the acid into the formation.

The use of packers has become a common practice with acidizing, and in conjunction with the Carr method it has been possible to put the tubing perforations within 3 ft. of an uncemented casing seat with no harm to the seat.

A method known as "successive treatment of new wells" is used when drilling into a formation having several producing streaks.

The concentration of acid used in Kansas should be varied between the limits of 7 and 15%, depending on a number of factors.

The volume of acid depends on many factors, and it is impossible to generalize. It has been the general practice in Kansas to use a larger volume in the second treatment than in the first, and to use a still larger volume in the third.

In general, it may be said that the results obtained by treatment in this area have been favourable. L. V. W. C.

766. Dust Storms Require Equipment Protection. F. B. Taylor. *Oil Weekly*, 27.5.35, **77** (11), 31.—The dust storms recently experienced in many parts of the United States have become a serious problem, and one of the most acute is adequate air filtration to power units. Two general types of air cleaners have been found satisfactory: (1) dry, and (2) fluid cleaners.

Covering intermediate and rear cross-head guides and keeping greases in air-tight cabinets are being practised. The seams in metal buildings are soldered or caulked, and window-frames are protected by narrow strips of rolled paper. L. V. W. C.

767. Stage Separation of Crude Oil and Gas Mixtures. W. F. Matheny, J. F. Langham, W. F. Cloud and R. L. Huntington. *Oil & Gas J.*, 2.5.35, **33** (50), 52.—Separation of gas from crude oil may be accomplished by (1) flash vaporization (continuous operation) at constant temperature and pressure, in which the vapour is in equilibrium with the liquid, (2) differential vaporization (batch operation) at varying temperature or pressure in which the vapour is removed as rapidly as it is formed, and (3) differential flash vaporization or stage separation in which the vapour is removed from the liquid in several flashes at different pressures. Where maximum vapour removal is required, as in crude oil distillation, method (1) is used, but for the production of crude oil, where the retention of gasoline is required, stage separation is best employed.

A laboratory study has been made of the variable factors such as temperature pressure, number of stages, gas–oil ratio in the separation of gas and oil, and of the physical properties of the gas and oil, with a view to designing such separating systems on a more scientific basis.

Preliminary data were obtained on the two-stage separation of gas from Tonkawa crude oil, in an apparatus designed for this purpose (description given), and calculation was then made of the behaviour of a mixture of 25 mol.-% of ethane and 75 mol.-% of hexane. From a graph of the data obtained, it is observed that the optimum pressure ratio between the high- and low-pressure stages was practically the same for Tonkawa crude oil and the ethane–hexane mixture. Similar calculations on a hypothetical crude consisting of methane, butane, gasoline and kerosine, indicating that the advantage gained by additional stages beyond two separators, falls off rapidly. Release of the greater part of the gas at the higher pressures is shown to reduce entrainment of crude oil in the lower-pressure separators. Data are presented showing the results of tests made in the John Fitts Pool near Ada, Okla., to determine the relation between amount of entrainment and separator pressure.

It is concluded that stage separation of oil and gas offers to the crude oil producer the advantages of:—(1) High-back pressures prolonging the natural flowing periods through a reduction on gas–oil ratios. (2) Increased A.P.I. gravity of crude oil.

However, in open storage for long periods this gain may be greatly offset by evaporation losses. (3) Less oil lost in gas lines through entrainment.

To the natural gasoline manufacturer it offers the advantages :—(1) The gas can be handled through smaller lines and the investment in compressor equipment can be postponed. (2) Less crude oil mist is carried to the plants to contaminate the absorption oil.

The assistance of oil companies is sought in the contribution of actual field data for correlation with laboratory results. C. L. G.

768. Preliminary Consideration of Natural and Artificial Flowing Methods in the Fitts Pool. S. F. Shaw. *Oil Weekly*, 22.4.35, **77** (6), 25.—The total depth of the lowest known productive formation in the Fitts Pool ranges from about 4200 to 4500 ft., with initial pressures at 1870 lb. and gas–oil ratios of 500 cu. ft./brl. The initial productions for this field are high.

The spacing for this field appears to have been agreed upon at one well to 10 acres. The wells are completed with a variety of casing sizes and with tubing, the flow being through the tubing.

No lifting equipment is required at present, owing to the prevailing high pressures, but as the pressures decline difficulties in starting the wells will increase and starting valves will be needed. Later compressors will have to be employed to flow the wells.

It may become desirable to instal gasoline plants in the Fitts field, and after stripping the wet gas of its gasoline the residue gas can be delivered to the gas-lift plant for compressing to whatever pressure is required for lifting the oil. L. V. W. C.

769. Determination of the Oil Content of Sands for Water-Flooding. W. L. Horner. *Petr. Eng.*, April 1935, **6** (7), 33.—The author describes and discusses the various tests used in testing cores of the reservoir sands for their saturation and oil content. L. V. W. C.

770. Technique of Securing and Examining Sub-surface Samples of Oil and Gas. R. J. Schillkius. *Oil & Gas J.*, 16.5.35, **33** (52), 69.—A knowledge of both the physical transformations and energy changes occurring with changing pressures and temperatures is required for the solution of many production problems. A study of problems dealing with the prediction of reservoir-pressure decline requires similar information.

The development of instruments for measuring sub-surface pressures has enabled much information to be collected during the last three or four years, but owing to the limited knowledge on the behaviour of complex hydrocarbon mixtures under the high pressures encountered in the reservoirs, these data have been difficult to utilize.

A full description and operation of a sampler is given, together with some data on auxiliary laboratory equipment required for examining sub-surface samples. L. V. W. C.

771. Relation of Bottom-Hole Pressure to Production Control. D. L. Katz and W. H. Barlow. *Oil Weekly*, 15.4.35, **77** (5), 27.—Bottom-hole pressure measurements assist in producing crude oil more economically by increasing the ultimate recovery of oil, by decreasing the equipment investment and by making reserve estimates of oil and gas reliable. Production of water-drive pools has been controlled by the use of shut-in bottom-hole pressure measurements, resulting in an increase in ultimate recovery and a lengthening of the flowing life. Pressure measurements make it possible to predict lifting methods and oil and gas reserves on gas-drive pools. The decrease in bottom-hole pressure while pumping wells may be used to assure operators that the pumping equipment is suitable to any particular well. L. V. W. C.

772. Economic Significance of the 10,000-ft. Well. J. F. Dodge. *World Petr.*, 1935, **6**, 202–207.—Expresses the view that the limiting factor in the exploitation of deep reserves is economic rather than mechanical. Improvements in equipment and technique by drilling engineers have mastered the problems of penetration to extreme depths. These improvements are, however, far ahead of corresponding production equipment and technique. The rod pump appears to have reached its depth limit at 7500 ft., and, due partly to mechanical difficulties, partly to economic considerations caused by high operating costs and partly to high back pressures on the formation, the straight-gas-lift method of production also appears to have reached its limit at this depth. Intermittent gas lifts, electrically operated deep well pumps and hydraulic

plunger pumps have been and are being used in an attempt to recover at a profit the substantial amount of oil left in the formation at the end of the well's flowing life, but to date little hope can be offered that the profit from such operations will form any appreciable addition to the profits derived from operations during the well's flowing period. This condition limits, economically, possible deep drillings to fields where high-pressure sands of considerable thickness exist from which wells of relatively long flowing life may be obtained.

With the purpose of presenting as briefly as possible a *résumé* of current deep-drilling practice and equipment in use, a table is appended to the article giving data on 13 representative wells which exceed 10,000 ft. in depth. W. W.

773. Waste of Natural Gas. Anon. *Engineering*, 1935, **139**, 297.—A recent report by the Petroleum Division of the U.S. Bureau of Mines indicates the enormous wastage of natural gas which takes place in the Texas Panhandle. During 1934—while the natural gas burned at the carbon-black works increased by 24% over that consumed in 1933, the amount delivered to pipe-lines rose by 15% and the quantity used on the oil-field as fuel increased by 25%—the actual wastage of the gas rose by as much as 76%. The Panhandle field comprises approximately 1,300,000 acres of oil and gas lands, in which there were, at the end of 1933, about 2800 wells, one-third of which were classed as gas wells. In addition, there were in existence 42 natural-gasoline plants with a total treating capacity of 2,000,000,000 cu. ft. of gas/day, and 25 carbon-black plants having a daily capacity of 600,000,000 cu. ft. The 9 pipe-lines, 6 of which are interstate systems, carry away on an average 408,000,000 cu. ft. every day.

Nowadays, of the daily average production of 2,400,000,000 cu. ft., no less than 1,323,000,000 cu. ft. go to waste. By its action in directing attention to the facts involved, the U.S. Bureau of Mines has performed a public service which will be of assistance in finding a solution for the economic utilization of such enormous and important natural resources. W. W.

Class 400. Transportation, Storage and Distribution.

774. Pipe Reconditioning Work Found Economical by United Gas System. E. S. Post. *Oil Weekly*, 13.5.35, **77** (9), 41.—Where corrosion is a problem it has been found to be more economical to recondition the whole pipe-line rather than replace worn parts only. The United Gas Public Service Company adopted this principle in the replacement of the Calliham unit of the Bruni–San Antonio trunk gas-line. A complete new line was laid, and when placed into use the old line was removed.

The removed pipe was then descaled and cleaned, and was placed on a rack, where it was sand-blasted. The pipe was then primed and coated with an insulating pipe covering and stacked until required. Before placing in the ditch the pipe was primed and coated a second time. L. V. W. C.

775. Unusual Difficulties in Laying Pipe-lines in Gulf Coast District. N. Williams. *Oil & Gas J.*, 25.4.35, **33** (19), 17.—Tremendous difficulties have been experienced in the laying of lines in the Gulf Coast area. Characteristics of the coastal country are expanses of almost impenetrable swamps, tidal marshes, waterways, and wide stretches of open water.

Ditching through swamp country has been all but impossible in most instances, but where possible gasoline motor-driven pumps mounted on pontoons have been used to follow the dredger. Dynamite has been used in those areas where hard work or the use of ditchers or dredgers has been impossible.

A number of lines have been laid across bays, and some of these have been placed on trestles, whilst others have been laid on the ocean bottom. L. V. W. C.

776. Reclaiming California Pipe-line. Anon. *Oil Weekly*, 13.5.35, **77** (9), 45.—The 96-mile line to be run from the lower San Joaquin Valley to Esters Bay, California, is composed entirely of recovered pipe which has been reconditioned in a plant built specially for this purpose.

The pipe is passed through a furnace operating at 1100° F., where all the old protective coatings and scale are removed. The screw threads are then cut with cutting torches and the pipe is bevelled. After testing for fitness for use, the pipe is sand-blasted

and unsuitable pieces are discarded. Lengths of 40 ft. are then made up and air tested to a pressure of 110 lb./sq. in.

The exact nature of the soil along the entire route is determined, and from such knowledge it is possible to lay bare pipe in the mild areas and highly protected pipe in those areas which show severe corrosivity.

The pipe is given a coating of hot asphalt, and the lengths are then pushed spirally through the coating machine in which the asphalt is squeezed against the surface under high pressure. A coat of whitewash is then applied, but the coating of the joints is not done until they have been welded together into the line. L. V. W. C.

777. Modern Reconditioning of Long Pipe-line. C. R. Stewart. *Oil Weekly*, 13.5.35, 77 (9), 21.—The largest reconditioning pipe-line job is that of the Magnolia Pipe-line Company. Approximately 470 miles of 8-in. line are to be reconditioned, and the methods to be employed are fully described.

Ditching to uncover the pipe is the first operation, and a gang then raises the uncovered pipe out of the ditch to a height of about 12 in. above the ground level.

A special cleaning machine is then run along the pipe, and all old paint, wrapping or other protective insulation is removed.

When the pipe is thoroughly cleaned and repaired, a protective covering is applied, and the pipe is then wrapped very tightly and a final coating of waterproof paint applied.

The pipe is then lowered carefully into the ditch, and the ditch is refilled.

L. V. W. C.

778. A.P.I. Pipe-Coating Tests—Progress Report No. IV. G. N. Scott. *A.P.I. Prod. Bull.*, No. 214, Nov. 1934, 18.—The results of the third inspection of the coatings on operating lines and second inspection of coatings on short pipe sections are presented. Besides confirming previous conclusions, the 1934 inspections have disclosed new information of practical value.

While complete prevention of corrosion by any of the coatings in these tests has not been realized, pitting has been materially reduced by most of the coatings. A consideration of the extent to which pitting has been retarded has led to the recommendation that shielding or reinforcing is a minimum practice in pipe protection under average soil conditions.

Soil stress is definitely progressive; hence the advisability of employing durable shields. The absorption of moisture by the coating now appears as a factor second in importance to soil stress. Methods of reducing moisture absorption are discussed.

For the purpose of arranging a variety of coatings in order of relative merit, tests on short pipe sections of small diameter do not agree closely with tests on large operating lines. W. W.

779. Cause of Corrosion in Alkali-knoll Soils. W. F. Rogers. *A.P.I. Prod. Bull.*, No. 214, Nov. 1934, 38.—It has been found through experience that pipe-lines on the Gulf Coast which pass through "alkali-knoll" soils are subject to a much higher corrosion rate than found in adjacent clay or clay-loam soils. An examination was made of the soil texture of a number of these alkali knolls, and it was found that they were composed largely of sand and silt particles—the clay content being very low or absent. To determine the cause of the high corrosion rates obtained in these soils, a study was made of two alkali knolls and one adjacent, but non-corrosive, clay-loam soil. The study included the determination of the annual soil-moisture variation, the electrical resistivity, soil texture, etc. In addition, the effect of various water concentrations on the corrosiveness of each soil was obtained by a laboratory test. The combination of the data from the field and laboratory measurements shows why the alkali knolls are more corrosive than the adjacent clay loam. The reason is largely that the clay loam was too wet to give rise to rapid corrosion rates, whilst the alkali-knoll soils were in a state of effective corrosion at all times. W. W.

780. Special Attention to "Hot Spots" has Reduced Corrosion Losses. B. Mills. *Oil Weekly*, 13.5.35, 77 (9), 35.—To successfully combat corrosion it is necessary to become familiar with the conditions existing along a pipe-line system. Exhaustive surveys to determine the resistivity of soils along the right-of-way are being carried out, since corrosion naturally becomes more rapid at points of lowest resistance.

One company in the Gulf Coast area has divided its external corrosion problem

into three phases: (1) the determination of "hot-spots" in the soil, (2) preventive measures against corrosion during construction, and (3) the restriction of corrosion in troublesome areas after placing the pipe in service.

Tests to determine the relative importance of moisture, oxygen and hydrogen sulphide in corrosion of pipe are being carried out.

Electrolysis is accelerating corrosion, and it is becoming common practice to pick up these stray currents, and so prevent unnecessary damage to the pipe.

L. V. W. C.

781. Wind-driven Generator Installation Provides Cathodic Protection. B. Mills. *Oil Weekly*, 13.5.35, **77** (9), 25.—As a check to pipe-line corrosion the Texas Pipe-line Company has developed a wind-driven direct-current cathodic protection unit.

This unit depends entirely on the prevailing winds for generating power.

The unit consists of a constant-current, variable-speed generator of special design, pusher type propeller of proper pitch and diameter to develop power required for the generator, speed increasing gear, vane and automatic brake. It is supported at a height of from 35 to 50 ft. depending on the particular territory.

The unit will start to rotate when the wind has attained a velocity of 9 miles per hour, but between lulls it will continue to rotate until the wind has receded to less than 2 miles per hour.

When the wind reaches a velocity of 23–25 miles per hour the brake stops the propeller until such time as the wind velocity is 22–20 miles per hour.

The negative pole of the generator is bonded to the pipe, whilst the positive current from the generator is carried by a suitable copper wire to a point of distribution in the ground. The copper lead line runs perpendicular to the pipe-line and connects to a heavy ground 1000 ft. from the generator. From the ground the current finds its way back to the pipe-line at hollidays in the pipe coating. The field of radiation at 1000 ft. from the line may be sufficient to protect a "hot spot" several miles in extent.

L. V. W. C.

782. Internal Corrosion Mitigated on Gas Line by Dehydration Plant. J. C. Albright. *Oil Weekly*, 13.5.35, **77** (9), 48.—As a result of serious internal pitting of a gas line, the Industrial Fuel Supply Company decided to instal a chilling process for dehumidifying the gas.

The ammonia refrigeration system placed in service to mitigate internal corrosion consists of three principal sections: exchangers, scrubbers and cooling elements. The minimum ground temperature taken along the line was found to be about 55° F., and at this figure and above no appreciable amount of water would be condensed from the vapours in the gas, and consequently would not cause any difficulty from that source.

A diagrammatic sketch of the chilling plant is given.

L. V. W. C.

783. Emergency Pump Repair. E. Sterrett. *Petr. Eng.*, May 1935, **6** (8), 38.—The fracture of the cast-steel side wall between the working barrel and the valveport chamber on one end of a duplex pump handling crude oil resulted in an interesting repair job, and the pump was kept in service until a replacement casing was obtained.

A short length of heavy 4-in. pipe to which had been welded two 1¼-in. threaded rods was fitted to the pump over the damaged spot. Across the outer ends of both rods a cross-piece of heavy steel was held by nuts on the rods. Heavy chains were used to hold this piece of pipe in place, and these were tightened until most of the slack had been removed. The pump was then put back in service and operated for one month and four days before shut down for replacement of the casting.

L. V. W. C.

784. Operating Experience in Use of High-speed Diesels on Pipe-lines. J. B. Harshman. *Oil & Gas J.*, 9.5.35, **33** (51), 34.—A number of high-speed diesel engines have been tried out in the pipe-line industry during the past two years, but although this type of unit has met certain of the necessary requirements, it has the disadvantage that it requires a special fuel oil for good operation.

A diesel engine which requires a special grade of fuel oil is not adapted for pipe-line gathering stations which may be located in isolated places.

The solution of the problem rests with the manufacturers of engines, and their efforts should be directed towards developing materials that will resist the elements causing the corrosion in the engine.

L. V. W. C.

785. Specifications for Tank Cars. Anon. *Chem. Fabr.*, 1935, 183.—Specifications for tank cars, as proposed by the "Deutsche Normenausschuss." L. S.

786. Kettleman Hills Well Flow Measured by Meters. B. Mills. *Oil Weekly*, 20.5.35, **77** (10), 15.—The use of meters for measuring oil from flowing wells has become a common practice in the Kettleman Hills field, and these meters are proving very successful, and are shown to give results which check so closely with the storage tank gauge that the error is negligible.

The flow from the well is passed through the traps to remove as much of the free gas as possible before metering. The gas removed from the oil is passed to the 500 lb. field wet gas collecting line, and the oil is metered at about the same pressure. The oil and gas that remain in solution after metering at the 500 lb. pressure, go to the 50 lb. group of traps, from which the oil goes to the field storage tanks. The gas is taken off the 50 lb. traps and sent to the gas plant for compression to 500 lb.

Various sizes of orifice meters and current type meters are used, the latter being of the velocity type. L. V. W. C.

787. Spreading of Mineral Oils on Water. R. Schubert. *Oel und Köhle*, 1935, **11**, 327.—A discussion of factors influencing the spreading of oils spilt on water, particularly in the vicinity of harbour works, with special reference to fire risk.

Crude oil tends to agglomerate into patches of relatively small total area rather than to form a continuous film. The extent of spread of volatile oils (benzine, benzole, etc.), which evaporate continuously, depends on their rate of discharge upon the water surface and on climatic conditions. The fire risk of a benzine film is mitigated by the rapid disappearance of the spirit by evaporation. It is shown by example that the fire risk of medium and heavy oils spilt on water is greater than is generally supposed. P. G. H.

Class 500. Properties and their Determination.

788. Estimation of Colour of Mineral Oils by Means of Absorption Measurements. E. Lederer. *Petr. Zeit.*, 22.5.35, **31** (21), 1–4.—Absorption measurements have been carried out as far as possible in the whole range of the spectrum, using a Pulfrich Photometer. A formula has been devised for estimating the colour of an oil by means of two constants, colour depth represented by F_t and colour tinge by F_s. These values are read from a specific Raster system, and not by calculation. The colour depth is defined as the log. of the extinction coefficient at the point of maximum intensity in the solar spectrum (530 mμ), and the colour tinge as the tangent of the angle of inclination of any straight line through which the log. of the extinction coefficient is represented in the Raster system. The greater F_s, the greater the red tinge and the less the yellow tinge of the oil. The greater F_t the darker is the colour. Bright oils have values for F_t of zero and negative values.

The characteristics shown by the new factors are claimed to be useful in connection with the bleaching process, artificial ageing of oils and with the determination of sludge. Oils of quite different chemical composition are differentiated by both constants. W. S. E. C.

789. Motors and Fuel Vapour Pressure. T. A. Boyd. *A.S.T.M. Proc.*, 1934, **34**, Pt. II, 540–549.—It is suggested that the Reid vapour-pressure limits for gasoline proposed by the A.S.T.M. Committee on Vapour Lock, viz. for 100°, 85° and 75° F. max. atm. temp. 8, 10 and 12 lb. respectively, are unsatisfactory. The application of Reid vapour pressure as a measure of vapour-locking tendency is limited, since two gasolines of the same vapour pressure at 100° F. may give quite different volumes of vapour at the temperature of the fuel system of the car. Reid vapour-pressure limits, therefore, should not be fixed too high. The author suggests that the highest vapour pressures of gasoline to give freedom from vapour lock at air temperatures of 95°, 80° and 65° F. are 8, 10 and 12 lb., respectively, a greater degree of freedom from this trouble being provided for at lower temperatures than at high. C. C.

790. Determination of Vapour Pressure of Hydrocarbons. Schmitt. *Ann. des Comb. Liq.*, 1935, **10**, 268–270.—In the determination of vapour pressure of hydrocarbons, the liquid is freed from dissolved gases by repeatedly solidifying in liquid air and subjecting to a high vacuum. The apparatus is very briefly described (but not

illustrated). The relation between pressure and temperature is given by Antoine's formula $\log p = A + \frac{B}{C + t}$, and the heat of vaporization by the formula due to Clapeyron $L = 4{\cdot}57B \cdot \frac{T^2}{(C + t)^2}$. Values of A, B, C, dp/dt, dt/dp, and C are given for *n*-hexane, methyl*cyclo*pentane, benzene and toluene. C. C.

791. Continuous Distillation of Petroleum in the Laboratory. C. Walther. *Oel und Kohle*, 1935, **11**, 324–326.—A calculation, based on Raoult's law of partial pressures, is applied to a two-component, non-azeotropic system to demonstrate the following advantages of continuous, constant-temperature distillation over batch distillation: (1) A given distillate is obtained at a lower temperature, (2) the yield of distillate at a given temperature $T°$ is greater than by batch distillation to end temperature $T'°$.

These conclusions were found by experiment to apply to petroleum; in the case of lubricating oil fractions, continuous distillation gave the better separation from asphalt.

Details and diagrams of a laboratory continuous still for evaluating crude oils are given. The oil flows slowly through a preheater into an electrically heated vaporizing chamber, two types of which are described: (*a*) allowing of reflux and (*b*) without reflux, the oil flowing in a thin film over the vaporizer and being distilled instantaneously. P. G. H.

792. Testing Heavy Oils. O. C. Blade. *Oil & Gas J.*, 28.3.35, **33** (45), 25.—The Hempel method has been found unsatisfactory for distillation of heavy oils at absolute pressures lower than 40 mm. of mercury. The Bureau of Mines has developed an apparatus permitting distillation at absolute pressures as low as 5 and even 1 mm. mercury. The distillation flask is of 500 ml. capacity and of the Hempel type, but the column is shortened to 6½ in., and a side arm ⅜ in. diameter and 2½ in. below the top is attached. The wider side arm helps to prevent fluctuations in pressure and spattering. A bulge in the column opposite the side arm guides reflux down the outlet tube and avoids excessive refluxing. The flask and side arm are insulated with an observation window near the bulge in the column. A 3-bulb glass condenser is connected to the side arm of the flask by strong rubber tubing shellaced at the edges to stop leaks. The receiver is a glass cylinder 12 in. high and 6 in. in diameter, clamped between two metal plates. A circular rack holds 10 graduated test tubes which can be placed in turn under the condenser tip by an electromagnetic device which eliminates the need for a stuffing-box. To maintain the desired pressure without fluctuation, air is bled into the system from a partly evacuated chamber connected to the receiver via a stopcock. Other apparatus comprises a vacuum pump, electric heater for the flask, mercury manometer and a Hickman vacuum gauge for detecting leaks. The cork fitted with A.S.T.M. high-distillation thermometer is sealed into the flask by means of a paste of litharge and glycerin, a syrup of flake shellac and alcohol being subsequently applied when the paste has dried. 300 ml. of oil, based on the Sp. Gr. at 100° F. (which is the average receiver temperature), is used for the test, and the distillation rate is maintained constant at about 2·5 ml. per min. The test procedure is detailed. Results obtained on a reduced Mid-Continent crude at 5 and 1 mm. absolute pressures and at 40 mm. on the Bureau of Mines Hempel apparatus are plotted on a chart. A table shows the corresponding divisions into non-viscous and viscous distillates, and residuum and loss. At 1 mm. pressure the yields of viscous distillate and residue were 40·2% and 6·0% respectively, and at 40 mm. pressure 4·6% and 41·2% respectively. The distillation at low pressures will enable the refiner better to judge the value of a crude. R. A. E.

793. Motor Fuels and Vapour Lock. G. G. Brown. *A.S.T.M. Proc.*, 1934, **34**, Pt. II, 550–559.—Results are reported of road tests in which the fuel line temperature at which vapour lock occurred was compared with the Reid vapour pressure at 100° F. of the fuel in the main tank. Critical vapour-locking temperatures in the fuel line vary over wide limits on different cars and under different driving conditions. Highest temperatures are reached under idling conditions after a period of heavy driving. It is considered that the recommendations of the A.S.T.M. Sub-Committee on Vapour Lock, viz. that the Reid vapour pressure of fuels as delivered for use at maximum

atmospheric temperatures of 100°, 85° and 75° F. should not exceed 8, 10 and 12 lb. respectively, should ensure reasonable freedom from vapour lock so far as the fuel is concerned. C. C.

794. Reid Vapour Pressure. N.G.A.A. Technical Committee. *Oil & Gas J.*, 28.3.35, **33** (45), 90.—The sources of error are leaks in the assembled bomb, errors in the pressure gauge, residual gasoline in the Bourdon tube and method of sampling. Assuming that samples are taken by the best accepted procedure, cooled to 32–40° F. before pouring, that a precision thermometer reading to 0·2° F. be used in the water-bath and that the bomb be left in the water-bath at least 17/20 mins., a table has been drawn up showing the estimated possible errors in Reid V.P. with moderately careful manipulation. The errors include sampling and pouring, air saturation, pouring temperature, air-chamber temperature, bath temperature, reading pressure gauge, time for equilibrium in water-bath, and variation in Reid chamber volumes. The sum of these errors is 2% at 7 lb., rising to 3·76% at 35 lb. The effect of each factor has been carefully investigated, and full details of the work and the results obtained are presented. As sampling and pouring errors can be almost entirely eliminated by the methods indicated in the article, it should be possible in all cases to repeat results within 2%, and if greater deviations are found on duplicate samples, special attention should be directed to the testing procedure used with a view to correcting probable faults in procedure. R. A. E.

795. Series of Viscometer Tips to Cover a Wide Viscosity Range Proposed. H. G. Nevitt. *Nat. Petr. News*, 3.4.35, **27** (14), 27.—In order to increase the range of application of the Saybolt Viscometer it is suggested that tips other than the "Universal" and "Furol" be adopted. A "Road Oil Tip" is already in tentative use. This jet gives efflux times one-tenth of those obtained with the "Furol" jet, and is being used in the examination of liquid asphaltic bitumens. The author suggests that four tips might be standardized and that they should be calibrated to give factors for the direct conversion of efflux times to kinematic viscosity. The suggestion is supported by a theoretical discussion of the relation between tip diameters and efflux times, and the probable diameters of the four tips proposed are deduced. H. G.

796. Viscosity Characteristic is Derived from Viscosity and Gravity. Anon. *Nat. Petr. News*, 10.4.35, **27** (15), 38.—A further refinement in connection with the viscosity/temperature chart as devised by Albersheim, Konheim, and Larson enables a graphic determination of the viscosity characteristic of an oil from the specific gravity (or A.P.I. number) and viscosity at the same or different temperatures to be made as simply as from two viscosities at different temperatures. H. G.

797. Conductivity of Oils and Waxes. A. Gemant. *Nature*, 1935, **135**, 912.—A few years ago the author detected a region of negative temperature coefficient of conductivity of heavy oils, viz. a rising conductivity with decreasing temperature which occurred in the neighbourhood of the solidifying point. A similar phenomenon has been observed with paraffin wax by W. Jackson (*Nature*, 1934, **133**, 647), and the effect is probably a characteristic of hydrocarbon oils and waxes.

The author puts forward a theory to account for this. The transition between the glassy and crystalline phase in an oil must extend over a range of temperature, and the conductivity in this range is therefore that of a two-phase system. Extrapolation of the conductivity of the glassy phase in the experimental curves suggests that this is lower than for the crystalline phase. The effect noticed may thus be explained by progressive crystallization with decreasing temperature, and this theory also accounts for the pronounced dielectric absorption in this region.

If this theory is correct, it is possible to calculate from experimental conductivity curves the melting curve and the relative amounts of components of given "melting point." Certain conclusions as to the approximate chemical composition of oils can also be reached. D. L. S.

798. Solubility of Mineral Oils and Tar Fractions in Liquefied Hydrogen Sulphide. E. Terres and W. Vollmer. *Petr. Zeit.*, 8.5.35, **31** (19), 1–12.—The following binary systems of hydrogen sulphide with mineral oil and tar constituents have been investigated: benzole, toluol, phenol, *o*-cresol, naphthalene, *β*-methylnaphthalene, anthracene, phenanthrene, octadecane, hexahydrobenzole and quinolin.

It was found that all the organic substances investigated gave only one liquid phase. Heterogeneous ring compounds such as quinolin, monocyclic ring hydrocarbons, *e.g.* toluol, benzole and hexahydrobenzole, are miscible in any proportion with liquefied hydrogen sulphide at 0° C. Phenol, *o*-cresol, dicyclic hydrocarbons such as naphthalene and β-methylnaphthalene are very soluble. The graphs given showing the relationship between mol.-% H_2S and temperature indicate that the heats of fusion curve for tricyclic hydrocarbon such as anthracene and phenanthrene cut the critical line of hydrogen sulphide.

Toluol, phenol, β-methylnaphthalene and quinolin form intermediate compounds $2C_6H_5OH{\cdot}CH_3{\cdot}H_2S$, $2C_6H_5OH{\cdot}H_2S$, $4C_{10}H_7CH_3{\cdot}H_2S$, and C_5H_7N,H_2S. Octadecane and hexahydrobenzole form mixed crystals with liquefied hydrogen sulphide.

Various graphs are given showing the relationship between the heats of fusion and temperature and concentration of the organic compounds with hydrogen sulphide.

W. S. E. C.

799. Activity Coefficient of Gases. R. H. Newton and B. F. Dodge. *Ind. Eng. Chem.*, 1935, **27**, 577.—In a previous paper (*Ind. Eng. Chem.*, 1935, **27**, 302) one of the authors presented graphs showing the activity coefficient (fugacity divided by pressure) for a large number of substances for which data were available. The calculated activity coefficients were correlated by the law of corresponding states.

In the present paper equations are developed by means of which the charts referred to may be used to predict the effect of pressure on the equilibrium of a gaseous reaction and to calculate the integral Joule–Thomson effect. The accuracy of the method is shown by comparing the predicted values with those obtained experimentally for ammonia equilibrium. Excellent agreement is obtained at pressures up to 600 atm., and good agreement up to 1000 atm. In the second case the Joule–Thomson effect is calculated for air, helium, propane, steam, pentane and hydrogen, and compared with experimental figures. The agreement is fairly good in this case. P. D.

800. Rôle of Methyl and Methylene Radicals in Decomposition of Methane. L. S. Kassel. *J.A.C.S.*, 1935, **57**, 833–834.—Kassel reviews the experimental evidence in favour of the decomposition of methane being represented in the preliminary stages by: $CH_4 = CH_2 + H_2$. The hypothesis, suggested by Rice and Dooley, which requires the formation of methyl radicals, is considered by Kassel to be inadequate to explain the experimental kinetics of the reaction. W. E. J. B.

801. Detonation in Injection Engines. M. Aubert, P. Clerget and R. Duchêne. *Ann. des Comb. Liq.*, 1935, **10**, 270–273.—An apparatus is described, and diagrammatically illustrated, by means of which single or double injections can be made, either concurrently or in sequence, into a cylindrical explosion chamber, 100 mm. long and 33 mm. diameter. The chamber is fitted with a piston, is electrically heated, and furnished with a window through which photographs of the explosions may be taken. Timing sparks, recorded on the photographic film, allow the lag in combustion to be studied. Two types of explosions are found, *i.e.* normal and detonating. In the latter case, detonation waves travel back and forth the chamber at a speed of the order of 1000 metres/second. Typical examples are described. When an injection of gas oil and one of ethyl alcohol, the latter, equal to one half the quantity of the former, were made together; the detonation obtained with gas oil alone was eliminated. Benzyl alcohol and benzaldehyde also possess anti-detonating qualities. The latter, indeed, is very effective. The experiments thus support the view that in order to avoid detonation it is necessary to furnish bodies capable of easily fixing oxygen, *e.g.* divided metals, alcohols, aldehydes, etc. Peroxide formation is thus avoided. Some flame photographs are appended. W. E. J. B.

802. Effects of Detonation in Engines. R. Duchêne and J. Verdier. *Ann. des Comb. Liq.*, 1935, **10**, 265–267.—The authors have investigated the manner in which the contacts in the bouncing pin circuit are closed by various degrees of detonation. With a light knock, a single closure occurs, but with a heavy knock, two, three, four or more closures may occur. The pin rebounds from diaphragm to contacts for a period which may be an important fraction of the engine cycle. With an Armstrong engine, this period lasted one-fifth of the cycle in a particular instance. An apparatus is described, by means of which the deflection of the diaphragm as caused by detonation in actual engine operation may be simulated by means of a known force. This is caused by

allowing a small plunger of known mass to strike the centre of the diaphragm at a known velocity. The bouncing pin and ancillary apparatus are fitted above the diaphragm. It is thus possible to reproduce a given knock meter reading in terms of the mass and speed of the plunger. Thus in a cylinder of 100 mm. bore, the shock of violent detonation was equivalent to the fall of a 10 kg. weight striking the piston face with a speed of 3·6 metres/sec. W. E. J. B.

803. Influence of Temperature on the Explosion of Mixtures of Air and Hydrocarbons. P. Mondain-Monval and R. Wellard. *Ann. des Comb. Liq.*, 1935, **10**, 278–281.—A mixture of air and hexane vapour, richer than theoretical, was heated in a steel bomb under an initial pressure of 5 kilograms. At a given temperature the mixture was fired by means of a spark, and the resultant pressure rise measured by means of the distance a steel point, on the end of a small cylindrical piston, was driven into a block of lead. Thus, by varying the firing temperature, a graph connecting same with explosion force could be constructed. It was found that below 180° C. the explosion pressure was independent of temperature, but that above this temperature the explosion pressure increased enormously with temperature, particularly as the spontaneous ignition temperature, 232° C., was approached. This behaviour is linked up with the formation of alkyl peroxides. Substituting benzene for hexane results in quiet combustion over this temperature range, the explosion pressure being independent of firing temperature. W. E. J. B.

804. Critical Phenomena in the Oxidation and Self-Inflammation of Hydrocarbons. A. Egerton and A. R. Ubbelohde. *Nature*, 1935, **135**, 997–998.—Neumann and Aivazov's phenomenon of a negative temperature coefficient of the combustion of hydrocarbon mixtures under certain conditions (*Nature*, 1935, **135**, 655) has been referred to by several workers and seems well established. Their explanation is a formal presentation of views which have been put forward regarding hydrocarbon combustion, the peroxide theory and knock in engines.

The peroxide theory postulates that the oxidation of the hydrocarbon to an aldehyde takes place via an intermediate peroxide. However, in favourable circumstances this intermediate stage can give rise to chain branching, and hence eventually to ignition in a lower temperature range. The conditions favouring chain branching are important in connection with the phenomenon of knocking. Thus anti-knocks lower the effective concentration of the intermediate peroxide, whilst the efficacious pro-knocks all seem to disrupt in such a way as to lead to a similar type of branching, which in turn leads to a reformation of the peroxide. D. L. S.

805. Ignition of Turbulent Explosive Mixtures by Electric Sparks. R. V. Wheeler. *Fuel*, 1935, **14** (5), 147.—Experiments on the inflammation of mixtures of (1) ethane and air, (2) methane and air, (3) carbon monoxide and air in a closed spherical vessel in which the mixtures were ignited at the centre by a secondary discharge, have demonstrated that the effect of turbulence is to render the mixture more difficult to "ignite."

Turbulence was produced in these experiments by the use of a rapidly revolving fan in the closed explosion vessel and degree of turbulence was varied by adjustment of the fan speed. The process of inflammation was followed by timed photographs.

This influence of turbulence is mechanical, since general inflammation of a mixture is dependent on the production of a sufficient volume of flame around the spark-gap and if the heat so generated is dissipated by the rapid delivery to it of a stream of unburnt and unheated mixture, the flame is extinguished. To compensate for such a dissipation of heat, a more intense secondary discharge is required to cause general inflammation. E. N. H.

806. Control of Engine Tests by Exhaust Gas Analysis. C. Bonnier. *Ann. des Comb. Liq.*, 1935, **10**, 199–232.—A theoretical combustion diagram, originated by Grebel, is described by means of which exhaust gas analyses can be checked. The degree of richness of the mixture supplied to the engine is defined as the ratio of the weight of air necessary for exact combustion to that actually used. For all fuels, within very close limits, a plot of oxygen content or carbon monoxide content of the exhaust gas against degree of richness gives a single pair of lines. It is necessary to correct the observed analysis to a "reduced analysis," since in practice one almost always finds carbon monoxide, dioxide and oxygen present together, and the theoretical treatment

given in the derivation of the diagrams requires that carbon dioxide and only one of the other two gases shall be present. This correction is simple. The apparatus is described and sampling discussed, whilst photographs of the apparatus mounted in, for example, an airplane, are shown. The use of exhaust gas analysis towards the solution of the following problems is discussed: Carburettor control, distribution and volumetric efficiency, thermal balance and the composition of the fuel.

W. E. J. B.

807. Anti-knock Effect of Tetraethyl Lead. J. M. Campbell, F. K. Signaigo, W. G. Lovell and T. A. Boyd. *Ind. Eng. Chem.*, 1935, **27**, 593.—Data are given on the effectiveness of tetraethyl lead in increasing the critical compression ratio of individual hydrocarbons. Quantitative measurements were made of the specific anti-knock effect of the lead compound (1·0 c.c. per gall.) on sixty-two hydrocarbons using a single-cylinder variable-compression engine. The hydrocarbons examined were paraffins, olefines, naphthenes, aromatics and unsaturated cyclic hydrocarbons: broad outlines of their methods of preparation are given. The data obtained are tabulated and also shown graphically by plotting critical compression ratio against increase in compression ratio for an addition of 1 c.c. of tetraethyl lead per gall. Generally, it is seen that with paraffins and naphthenes, lead is progressively more effective. With olefines, diolefines and acetylene compounds, the effectiveness of lead shows relatively little variation irrespective of the critical compression ratios of the compounds examined. With certain unsaturated cyclic compounds, a progressive lowering of the effectiveness of lead is noted as the critical compression ratio of the compound increases. Lead is seen to be very effective in aromatic compounds. With regard to the relationship of structure to lead effectiveness, there are indications that the compounds in which lead is more effective are those which have a double bond removed from the end of the molecule. As the double bond is progressively moved towards the centre of the molecule, the effectiveness of lead in the compound increases. The opposite condition, however, seems to hold for acetylene compounds. In the case of the olefines with the double bond next to the terminal carbon atom, or in the α position, the lower members of the series are those in which lead is more effective. Compounds containing a benzene ring with a saturated side-chain are those in which lead is particularly effective, but introduction of unsaturation in the side-chain reduces the lead response. Compounds containing a triple bond in a conjugated position to the benzene ring showed a negative effect, whilst one compound (1-phenyl-1 : 3-butadiene) appeared to be quite neutral to lead.

W. H. T.

808. Isomerization of *n*-Heptane. G. Calingaert and D. T. Flood. *J.A.C.S.*, 1935, **57**, 956.—Pure *n*-heptane from Jeffrey pine was heated on a water-bath in the presence of aluminium chloride. The reaction product was found to contain *n*-hexane and 2-methylhexane, but these represented only a small percentage of the *n*-heptane consumed in the reaction. Further work on this reaction is in progress.

W. E. J. B.

809. Substituted *o*-Aroylbenzoic Acids in the Identification of Aromatic Hydrocarbons. H. W. Underwood, Jr., and W. L. Walsh. *J.A.C.S.*, 1935, **57**, 940–942.—Nineteen aromatic hydrocarbons have been condensed with either phthalic anhydride or tetrachlorophthalic anhydride to yield *o*-aroylbenzoic acids or *o*-aroyl tetrachlorobenzoic acids. These acids have definite m. p.'s and can be titrated, and hence offer a convenient means of identifying small amounts of aromatic hydrocarbons. The necessary experimental procedure is described, and results are given. W. E. J. B.

810. Synthesis of Methylcholanthrene. L. F. Fieser and A. M. Seligman. *J.A.C.S.*, 1935, **57**, 942–946.—The cancer-producing hydrocarbon methylcholanthrene has been synthesized in 11% yield from *p*-bromotoluene. W. E. J. B.

811. Direct Alkylation of Aromatic Hydrocarbons by Olefins under the Catalytic Influence of Phosphorous Pentoxide. B. W. Malishev. *J.A.C.S.*, 1935, **57**, 883–884.—Phosphorous pentoxide is insoluble in hydrocarbons, and so its effectiveness as a catalyst was dependent on producing and maintaining a large contact surface. Dispersions of the pentoxide were developed through the use of stabilizing colloids and peptizing agents. Among the former, lamp-black was found to be the best available, whilst cresol was an effective peptizer. The alkylation of aromatic hydrocarbons with olefins in contact with the stabilized dispersion of P_2O_5 becomes noticeable at

150°, with optimum temperatures of from 200° to 250° C. Pressures up to 40 atm. were used in the experiments, which included the following: benzene and ethylene to yield mono- and hexa-ethyl benzenes, benzene and *iso*butylene to yield *t.*-butyl benzenes, toluene and propylene to give *p*-cymene. The pentoxide had practically no polymerizing effect on the lower olefins by itself, but higher olefins may be polymerized to naphthenes. Experimental details are given. W. E. J. B.

812. Heats of Organic Reactions. II. Hydrogenation of Olefinic Hydrocarbons. G. B. Kistiakowsky, J. R. Ruhoff, H. A. Smith and W. E. Vaughan. *J.A.C.S.*, 1935, **57**, 876–882; cf. Abs. No. 304, 1935.—The values of the heats of hydrogenation of propylene, butene-1, the *trans* (low boiling) and *cis* (high boiling) isomers of butene-2, and *iso*butene have been determined. The values obtained vary from −27,621 cals./mol. for *trans*-butene-2, to −30,341 for butene-1, and do not bear out the theory of constant bonding energies. The results are computed to be accurate to about ± 60 cals. During the course of the work, the *cis*- and *trans*-isomers of butene-2 have been examined. The respective boiling points and melting points are *cis*-isomer + 3·73° and −139·3° C., *trans*-isomer + 0·96° and −105·8° C. W. E. J. B.

813. Action of Bromine on Butadiene. G. B. Heisig and J. L. Wilson. *J.A.C.S.*, 1935, **57**, 859–863.—The reaction between equivalent amounts of butadiene and bromine has been studied in small, medium and large spheres on surfaces of glass and paraffin. The product obtained is 1 : 4-dibromobutene. The reaction kinetics have been studied, and it is concluded that the reaction proceeds on a surface of reaction product rather than on the wall itself. W. E. J. B.

814. Construction of Glass Helices for Fractionating Column Packing. E. E. Roper, G. F. Wright, J. R. Ruhoff and W. R. Smith. *J.A.C.S.*, 1935, **57**, 954–955.—This note describes the construction of glass helices and contains useful directions for their manufacture. W. E. J. B.

815. Connection between the Physical Properties and Chemical Constants of Lubricating Oils. M. Freund. *Petr. Zeit.*, 8.5.35, **31** (19), *Motorenbetrieb und Maschinenschmierung*, 1935, **8** (5), 1–6.—A comparison is made of the properties of refined natural mineral lubricating oils of the same viscosity at 50° C. The mean b. pt., aniline point, apparent mol. wt., and the hydrogen content of the oils decrease regularly with increasing specific gravity. The viscosity/temperature curve also becomes steeper, the value for Conradson coke generally decreases and the content of aromatic or reactive hydrocarbons and the ease of oxidation increase.

The relation of the properties of oils is also affected by the type of refining and by the presence of asphalt-forming substances.

The work is amplified with tables giving analytical data. W. S. E. C.

816. New Laboratory Unit Measures the Resistance of Oil to Form Sludge. M. Fairlie. *Oil & Gas J.*, 28.3.35, **33** (45), 58.—An effort has been made in constructing this unit to duplicate as far as possible all the fundamental conditions to which oils are exposed in engines. On the assumption that contact with iron is desired, all parts are made of light sheet iron or iron pipe. The apparatus consists of a sump, from which oil is circulated by means of a Viking pump to a header tank, the rate adjusted to give a small overflow by means of a by-pass. From the heater oil flows through a needle valve via a syphon breaker and aerator, which governs air admission and results in a coarse foam of oil and air being fed to the heater, which consists of 40 ft. of ¼-in. pipe wound into a coil 20 in. in diameter equipped with annular-cage type heater elements, the whole being well insulated. From the heater oil flows to a cooler in which water is allowed to boil continuously when room temperatures exceed 80° F. The water feed is then just sufficient to replace evaporation, and the level controls the system equilibrium. Essential conditions employed are: 4 litres of oil in sump, 425° F. heater outlet temperature, 220° F. sump temperature, 300 mls. per min. flow through heater. The sump may be heated gently until a temperature of 200° F. is reached on commencing a test. Except in the case of unstable oils no further adjustments are usually necessary once equilibrium conditions are attained. Tests are normally run for 150 hrs., intermediate samples being taken at 50, 100 and 125 hrs. for tar and viscosity tests, oil from the latter being returned to the system. Finally the oil is weighed to obtain a measure of volatility loss and full tests are carried out.

It has been found advantageous to use a fine alundum instead of a Gooch crucible for the tar test, and also a naphtha of 86–88° A.P.I. gravity and carefully controlled specification. Laboratory results were correlated with road tests carried out with 17 cars running a total test mileage of 201,900 miles. It was found that the characteristics of the oil after 75 hrs. in the laboratory apparatus corresponded with those of the oil from the cars after 1000 miles, particularly in tar content. The viscosity increase of the diluent-free oil from the cars was approximately the same as that of oil from the test apparatus. Laboratory engine tests with varying jacket temperatures showed that ring sticking occurs with the following tar contents: at 180° F. 5%, at 212° F. 1% and at 250° F. 0·5%. As 212° F. can be regarded as the maximum jacket temperature normally encountered in automobiles, and as tar content and gasoline consumption increase rapidly once the tar content reaches 1%, the laboratory test apparatus is run until a tar content of 1% is obtained, and the useful life of the oil in service deduced on the basis of 75 hrs. per 1000 miles. The tester is capable of giving repeatable results and of indicating the effects of modifying treatment of the oil. Results obtained on basic oils of different origin and on some reclaimed oils are given. These oils were all of S.A.E. No. 30. Under city driving conditions, car results follow laboratory results as indicated, but under high-speed driving conditions oil viscosity affects crank-case temperature. Oils of lower viscosity by virtue of operating at lower temperatures therefore developed less tar in service than indicated by the laboratory tester in relation to the oils of higher viscosity. Knowing the average operating temperatures, correction factors can be applied. R. A. E.

817. Paraffin Wax. W. F. Seyer and K. Inouye. *Ind. Eng. Chem.*, 1935, **27**, 567.—Between — 10° and 30° C., the tensile or breaking strength of paraffin wax has been shown to vary considerably with temperature, reaching a maximum of 32 kg. per sq. cm. at about 3° C. The density was also measured over the same temperature range, but there appeared to be no direct linear relationship between the two quantities measured. The apparatus used for the investigation is described and illustrated.
W. H. T.

818. Chemical Constituents of Gasoline. F. D. Rossini. *Oil & Gas J.*, 16.5.35, **33** (52), 61.—The methods used and the results obtained in A.P.I. Research Project 6 on the separation of the chemical constituents of the fractions boiling between 55–145° C. and 145–180° C. of a Mid-Continent gasoline are fully described and discussed. Fractionation into the different hydrocarbons was effected by greatly improved methods of distillation, crystallization, adsorption and extraction. Distillation at reduced pressure (down to 0·0001 mm. mercury) assists separation owing to the fact that the vapour pressure–temperature curves of a paraffin and naphthene, normally boiling at similar temperatures, cross each other, so that in a certain pressure range the paraffin is more volatile than the naphthene, whilst in another pressure range the reverse holds good. Distillation in the presence of substances such as alcohol and acetic acid, which form azeotropic mixtures with one or more of the components, was also employed. Crystallization by refrigeration was used to separate the normal paraffins from distillation cuts, the mixture being first solidified and then slowly melted up and the impurities centrifuged off. Crystallization from solvents such as liquid methane, ethane, ethers, etc., enables separation of hydrocarbons which normally solidify to a glass on cooling. Solvent extraction was used to remove aromatic hydrocarbons from paraffins and naphthenes. For the same purpose adsorption with silica gel was used; and also to a smaller extent for the separation of naphthenes and paraffins.

The data on the composition of the gasoline fractions are presented in the form of (*a*) a figure showing the volume–temperature relationship of the fraction boiling between 55° and 145° C. before the removal of any of the constituents, (*b*) a composite chart showing the same relationship after the removal of various fractions, (*c*) tables showing the components of a number of fractions, with an indication of the method of separation and detection, (*d*) table showing the actual paraffin, naphthene and aromatic hydrocarbons (i) isolated, (ii) detected and in process of separation and (iii) suspected present in the 55–145° C. fraction, (*e*) table showing the estimated percentage of each hydrocarbon and its purity. Summaries of these tables indicate that in the 55–145° C. fraction, 23 paraffin, 18 naphthene and 6 aromatic hydrocarbons have been isolated, detected or suspected out of a total of 88 hydrocarbons known to be present.

In the 145–180° C. fraction *n*-nonane, *n*-decane, mesitylene, pseudo-cumene and hemimellitene have been isolated, out of 80 hydrocarbons reported to boil in this range. Other hydrocarbons probably present in this fraction are propyl benzene, ethyl toluene, butyl benzene, methylpropyl benzene, isomers of decane and certain naphthenes. It was noted that no olefine hydrocarbons were present in the fraction up to 180° C.

The potential benefits to the oil industry of this investigation include (*a*) possibility of separation of particular hydrocarbons of *e.g.* high anti-knock value, (*b*) better knowledge of thermal data in cracking, polymerization oxidation and hydrogenation reactions, (*c*) possibility of production of chemicals from hydrocarbons separated by the methods used in this investigation (*e.g.* aromatic hydrocarbons in straight-run gasoline are estimated to amount to 7 times production from coke industry), (*d*) availability of pure hydrocarbons for research work.

Further work on this project will include the separation of the remainder of the hydrocarbons in this fraction and the formulation of a systematic method for the separation of the naphtha fraction of any crude oil into its major chemical constituents. C. L. G.

819. Hormones from Bitumen. E. Graefe. *Tägl. Ber. Petr. Ind.*, 1935 (95).—Ascheim and Hohlweg (*neue mediz. Wochenschr.*, **59** (1), 12) have stated that bitumen contains oestrogenic substances; brown coal contains 400 mouse-units, montan wax, if extracted by benzole or alcohol, 5000, by methyl alcohol 100,000 units. L. S.

820. Patents on Testing. J. G. A. Rhodin, E.P. 426,876, 11.4.35.—A viscometer for liquids and gases comprising a narrow channel for passage of the fluid, the walls of which are movable in the direction of flow, being guided by a parallel motion mechanism. A gravitational control is applied so as to enable the movement of the movable wall to serve as a measure of the force exerted thereon by the fluid flow.

W. Helmore and A. A. Griffith, E.P. 427,260, 18.4.35. A method of testing lubricating oil in which the oil is continuously sheared by means of a free piston in a heated sealed cylinder containing a measured quantity of oxygen or other gas. The piston is reciprocated relative to the piston and the friction between the two is measured.

A. Hilger Ltd., E.P. 428,013, 3.5.35. A trichromatic colorimeter comprising a light source and a set of filters corresponding to three primary colours assembled in a single unit. W. H. T.

Class 600. Refining and Refineries.

821. Refining in United States and Canada. *Oil & Gas J.*, 28.3.35, **33** (45), 100–127.—A survey is presented of the personnel of petroleum refining companies in the United States, the growth of refinery capacity in the United States from 1914 to 1935 and the type and capacity of the cracking and refining plants shut down and in operation in each of the States. A list of the capacity and type of refineries operating in Canada is also presented. C. L. G.

822. Refining in Mexico. C. O. Willson. *Oil & Gas J.*, 28.3.35, **33** (45), 128.—Data are presented on the increase in refinery operation in Mexico during 1934 over that of 1935, with details of the personnel, type and capacity of the refineries, and with notes on recent extensions.

The crude oil output during 1934 averaged 104,550 brl. per day, a gain of 12% over the previous year. Of this production 70,000 brl. per day is refined in Mexican refineries, 32,000 brl. per day being exported. The domestic demand for all petroleum products in Mexico averaged 45,360 brl. daily, an increase of 23% over 1933, the increase in gasoline being 25%. C. L. G.

823. Petroleum Industry of 1935. J. B. Hill. *Ind. Eng. Chem.*, 1935, **27**, 519.—A brief survey of present-day developments of distillation, cracking and refining of petroleum. W. H. T.

824. Pressure Drop and Heat Transfer in Exchangers. S. A. Perrone. *Oil & Gas J.*, 28.3.35, **33** (45), 71.—The results of tests on a commercial heat exchanger in order to determine pressure drop, friction losses, velocity of flow and heat transfer are correlated and discussed. A shell and tube exchanger with different bundles of tubes of varying pitch and diameter and with different numbers of baffles (half-moon type) was used

for the tests, water being the liquid in the tubes and shell. A description of the apparatus and means of taking the different measurements is given. The selection of the particular methods used for calculating the overall transfer coefficients, shell side and tube side coefficients, velocity of flow and pressure drop is discussed. The necessity of frequent cleaning of the tubes in weak acid in order to obtain repeatable results is emphasized, data on new tubes being, however, not repeatable.

It is concluded that (1) the average velocity around cut out baffles on the shell side of a heat exchanger is determined by the components along and perpendicular to the tubes; (2) data on heat transfer on the shell side of a baffled heat exchanger may be correlated into a practically dimensionless relation; (3) baffling materially increases the rate of heat transfer on the shell side of a heat exchanger up to a point of maximum return; (4) an increase in tube spacing increases the shell side coefficient of a baffled heat exchanger; (5) the fluid friction losses determine the economical amount of baffling. C. L. G.

825. New Heating System for Stills. Eming and Kesper. *Oel und Kohle*, 1935, **11**, 281.—An indirect method of heating stills, especially tar distillation units, is described. Hot gases, constituting the heat-circulation medium, pass from an external oil- or gas-fired furnace to a cylindrical chamber ("candle") which projects vertically into the still at its base. The candle is thus submerged in the still charge. The effluent gases are then partly returned to the furnace; the rest is diverted to a jacketing space surrounding the upper part of the still, thus preventing refluxing from the walls. A special valve in the gas circuit enables the gases to be circulated under pressure, when optimum heat-transfer is stated to result.

The charge is kept stirred by means of a vertical stirrer carrying scrapers. The latter almost touch the candle, with which they revolve concentrically. This arrangement is stated to cause only a thin layer of liquid to be heated at a time. The stirrer is made hollow to allow the introduction of steam if desired. P. G. H.

826. Commercial Polymerization Plant. Anon. *Nat. Petr. News*, 1.5.35, **27** (18), 24 D.—A plant for the production of gasoline by the polymerization of waste refinery gases and capable of handling 3 million cu. ft. per day has been erected. A small pilot plant was used for development work. It consisted of four electrically heated contact towers and a stabilizer. The catalyst was phosphoric acid impregnated on an inert carrier. The gas, which contained about 25% olefins, was processed under pressure. Operating data for a run with the overhead gas containing 37·5% propylene and butylene from a stabilizing column show that with pressure and temperature constant at 100 lb. and 204° C. respectively, decreasing the rate of gas feed from 4·9 to 2·1 cu. ft. per hour per lb. of catalyst increased the yield per 1000 cu. ft. of gas from 5·4 to 6·5 gallons gasoline. The extent of polymerization was not increased by doubling the pressure, but greater yields were obtained by increasing the temperature to 234° C. The H_2S content of the gas was decreased by 60%, the sulphur appearing in the gasoline in the form of mercaptans. The gasoline produced has the following properties: Sp. gr. at 60° F., 0·728; Colour, Saybolt 30 +; Gum, mg./100 ml. (copper dish) 4; Octane Number (C.F.R. Motor Method), 82; Octane Blending Value (25% in Fuel A_3. C.F.R. Motor Method), 121; Reid Vapour Pressure, 5·0. H. G.

827. Gas Polymerization. A. L. Forster. *Nat. Petr. News*, 24.4.35, **27** (17), 35–40.—The production of gasoline from waste refinery gases is now on a commercial basis. Two processes are in use, the first polymerization in the presence of a catalyst, the second pyrolysis. In the first process the gases are passed at a temperature of 446° F. and a pressure of 200 lb. per square inch over a catalyst consisting of phosphoric acid impregnated in an inert solid carrier. It is claimed that this catalyst can be regenerated easily and completely by treatment with live steam and air, and that it is not poisoned by CO, H_2S or mercaptans. When running on receiver gas from a liquid-phase cracking unit and containing 24–25% total unsaturateds, yields of 3–4 gallons per 1000 cu. ft. were obtained, whilst stabilizer reflux from the "liquid-vapour" phase cracking process and containing 40% propylene and butylenes yielded an average of 6 gallons per 1000 cu. ft. Ipatieff has shown the mechanism of the polymerization to be a two-stage reaction. At relatively low temperature olefins react with phosphoric acid to form addition products, which at higher temperatures dissociate to form "nascent" organic radicals, which combine to larger molecules to form mono-olefins of, chiefly, twice the number of C atoms as in the original olefin.

It has been shown that the higher the average molecular weight of the gas the higher is the yield of polymers. In the pyrolysis process olefins are removed from the raw gas by selective absorption, freed from H_2S and fed to the unit as a liquid at 600–800 lb. pressure, and at an inlet temperature of 1100° F. The reaction is exothermic, and the main reaction zone is maintained by the heat of reaction at 1200–1300° F. The yields vary from 3 to 9 gallons per 1000 cu. ft., according to the composition of the gas and operating conditions. There are optimum conditions of time, pressure and temperature dependent on the nature of the gases. H. G.

828. **Gas Purification.** N. Heymann. *Mont. Rundschau*, 1935, **27** (10), 1.—An historical review of developments in electrical gas purification. In 1907, the first Cottrell plants were erected in U.S.A., in 1913 the patents were taken over by the Metall Ges., and in 1930, the Siemens–Lurgi–Cottrell Electrofilter Ges. was founded. The process is of importance for tar precipitation from generator and distillation gases. L. S.

829. **Solvent Refining Survey.** W. T. Ziegenhain. *Oil & Gas J.*, 28.3.35, **33** (45), 83.—Details are given regarding plants in use and under construction in the U.S.A. and other countries, showing the owning company, location of plant, date installed, solvent used, daily charge rate and output, nature of charge and a classification of V.I. of the output according to whether above or below 90. Total charging capacity is approx. 43,000 brl. a day and total potential output 28,200 brl., of which 23,000 brl. is within the U.S.A. R. A. E.

830. **Acetone–benzole for Dewaxing.** W. A. Myers. *Oil & Gas J.*, 28.3.35, **33** (45), 78.—The process can be applied to pressable wax distillates and to heavier oils previously handled by cold settling or centrifuging. As opposed to the centrifuge system, the cooling rate can be high, and the difference between chilling temperature and pour-point of finished oil is small. A plant in operation in Philadelphia is described and illustrated by a flow sheet and photographs. Oil/solvent ratio is fixed by flow controllers, and final chilling accomplished by direct expansion of ammonia. The mixture is then delivered to a surge tank held at 40 lb. pressure by compressed flue gas, and flows under this pressure to the filters. Dewaxed oil leaving the filters passes through heat exchangers to the solvent recovery system. The wax cake is discharged from the leaves of the filter by slight flue gas back pressure, and is carried away by a screw conveyor, finally passing to the solvent recovery system. There are separate recovery systems for pressed oil and for wax cake, each consisting of evaporators and stripping columns, the latter being interconnected. The strippings pass to a decanter from which the solvent layer is removed. This layer and the solvent from the wax-cake recovery system contain water, and both are bubbled through a soda-ash solution dryer to remove water. Water from the dryer and the water layer from the decanter are passed to an acetone/water still for recovery of acetone. Details of operation and construction of the plant are given.

The composition of the solvent must be adjusted to ensure insolubility of wax and also prevent formation of benzole crystals. In actual practice mixtures composed of 25–35% acetone, 12–25% toluol and the remainder benzole, have been found suitable, the more paraffinic stocks requiring less acetone, and the lower operating temperatures more combined acetone and toluol.

The ratio of solvent to charging stock varies from 2/1 to 4/1, according to the wax concentration and viscosity. Wash solvent may be used in the rotating leaf-pressure type filters which are employed; when the stock has a premium value or a limited quantity is available, washing is desirable and the proportion of wash solvent to charging stock may be 2/1. The oil–solvent mixture is chilled to a temperature about 5° F. below the desired pour-point. The plant has so far operated in 9 different distillates, ranging in viscosity from 100 secs. S.U. at 100° F. to 70 secs. S.U. at 210° F. and containing up to 20% wax. Analyses of charge and pressed oils, solvent ratios, final chilling temperatures and wash solvent usage are tabulated. In view of the good results obtained it is proposed to treat more viscous distillates and residual oils as need arises. R. A. E.

831. **Application of the Centrifuge to Distillation and Extraction.** Anon. *Nat. Petr. News*, 1.5.35, **27** (18), 34.—A unique application of the centrifugal principle to the design of equipment necessitating counter-current contact is illustrated in new

apparatus developed by W. J. Podbielniak. The apparatus consists of one or more spirals of tubing, of rectangular cross-section, mounted on a conical support, apex uppermost, and connected by liquid seals to the still below and the condenser above, if used for distilling. The coil is rotated with its support at high speed. The reflux liquid, therefore, is forced in an extremely thin layer downwards by centrifugal force. The vapours are forced upwards in intimate contact with the reflux by virtue of the difference in pressure in still and condenser. Apart from the intense scrubbing action, great economy of space is indicated. It is claimed that a unit capable of handling 1000 gallons of liquid per hour and with a fractionating efficiency equivalent to 100 bubble plates would occupy a space only $5 \times 5 \times 7$ ft. H. G.

832. Bleaching Effect of Bleaching Earths. E. Erdheim and O. Schneider. *Petr. Zeit.*, 17.4.35, **31** (16), 1–3.—The effect of bleaching earths such as fuller's earth, bentonite, Montana B & Z have been investigated using a sample of Boryslaw benzine which had been exposed to light for 2 years. These were standardized against an activated charcoal, all the earths being added to 50 ml. of the benzine in amounts of $\frac{1}{2}$, $\frac{3}{4}$, 1 and 2%, shaken for 10 mins., left to stand, shaken again after 1 hr. and then left for 18 hrs. The upper layer was filtered and the decolorizing effect determined in a Hellig Colorimeter. The final concentration of the dye and the quantity of dye absorbed were determined.

Freundlich's equation was then applied: $\log a = \log \alpha - 1/n \log c$, where a is the quantity of dye adsorbed, c the final concentration and α and $1/n$ constants. Alpha is obtained from the curve of log c plotted against log a and is the point at which the isotherm cuts the axis of log a. Fuller's earth and bentonite do not give straight lines, but the isotherms for both types of Montana earth consist of two parallel straight lines which cut the axis of a below zero.

The used earths were heated with alcohol and colorimetric determinations carried out on the alcohol extract. The results show that only very little of the adsorbed dyestuff is removed by the alcohol. W. S. E. C.

833. Earth Treatment of Gasoline. R. H. Price and P. L. Brandt. *Oil & Gas J.*, 28.3.35, **33** (45), 54.—The plant described handles the gasoline from cracking and topping units running 32,000 brl. a day of E. Texas crude. The feed consists of reformed heavy naphtha, vapour-phase cracked gasoline from light gas oil and recycle stock, compressed wet gas from depropanizing of straight-run light naphtha and from a fuel viscosity-breaker coil. The amount of straight-run products is less than 5%. The four clay towers are manifolded in parallel. Each tower is of 12 ft. internal diameter, 19 ft. 6 in. high and has a false bottom supporting 25 tons of 30–60 mesh clay. During the test period a single batch of earth composed of equal parts Floridin clay from Quincy, and fuller's earth from Midland, Fla., was used. Untreated vapours pass downwards through the clay, treated vapours are withdrawn below the false bottom, polymers and condensed hydrocarbons drain to a common polymer drum and are fractionated. Treated vapours are cut to E.P. in an after-fractionator, condensed and passed to a stabilizing system. The stabilized gasoline is blended with the depropanized straight-run light naphtha, and most of the data are presented on this final blend which is sweetened. Approximate temperatures and pressures employed are: Bubble tower overhead, 453° F. and 195 lb. per sq. in.; Clay tower outlet, 442° F. and 191 lb.; after-fractionator 426° F. and 190 lb. Products obtained in brls. per hr. are: cracked gasoline 582, polymers 29·5 and after-fractionator bottoms 176. The treating rate is 5·54 brls./ton per hr., equivalent to a contact time of about 140 secs. As clay life increases, the amount of liquid passing to the polymer drum increases, but the amount of high-boiling polymer (over 400° F.) decreases, on account of decreased heat effect of the clay. Steaming of the clay after each shut down for 12 hours with 110 lb. steam did not appear to effect marked revivification. Voorhees induction tests carried out on the unsweetened blend showed initially 600 min., falling to 400 after about 4000 brl./ton, but remaining at 340 min. after 12,000 brl./ton. The differences in induction periods between sweetned and unsweetened gasolines diminish with clay life. Copper dish gum was also correlated with clay life on the sweetened blend. Initially 4 mgm. per 100 ml., it rose to 12 mgm. after 11,000 brl./ton. A.S.T.M. tests showed no performed gum within experimental error at any time. Colour determinations by Saybolt instrument showed initially 30 + on the treated cracked gasoline and 23 finally, but the sweetened gasoline showed 27 and 25 +

respectively. Results obtained by an accelerated test for colour after storage in the dark showed little change in rate of deterioration of colour with clay life, but since the initial colours are lower with increased clay life, the time required to reach a given colour became shorter. Colour stability to sunlight varied from time to time, and it was found that this factor for the clay-treated gasoline is susceptible to small variations in sulphur used in sweetening. R. A. E.

834. Alcoholic Caustic Solution as Sweetening Reagent. B. A. Stagner. *Oil & Gas J.*, 2.5.35, **33** (50), 62.—A description is given of a method of sweetening straight-run and cracked gasolines containing mercaptans with elementary sulphur in contact with a very small amount of an alcoholic solution of anhydrous alkali. Similarly elementary sulphur may be removed by the addition of mercaptans (or preferably gasoline containing mercaptans) in the presence of alcoholic caustic solution. Frequently blending of sulphur- and mercaptan-containing gasolines, mixed with alcoholic caustic solution, will free the mixture from both substances. The alcohol, preferably methanol, serves to disperse the alkali throughout the gasoline in a fine state of division, and the alkali, if added in the minimum amount, is almost completely exhausted in the reaction. To treat 1 brl. of a typical California cracked gasoline, only a pint of alcoholic caustic solution was required. The essential reaction is oxidation of the mercaptans by sulphur, the mercaptans forming alkyl disulphides, and the sulphur, alkyl sulphide.

Data on the sweetening of cracked gasolines by this method with different quantities of reagents indicate the necessity of adding exact quantities of sulphur and alcoholic caustic solution.

The process has also been found applicable to the treatment of kerosine. Caustic soda is preferred to caustic potash owing to its cheapness, its solubility being 23 gm./100 ml. solution, although a 15-gm./100 ml. solution is preferable owing to easier dispersion in the gasoline. The sulphur is added either as a powder or preferably in solution in a small volume of the gasoline. The colour stability of the sweetened gasoline is generally adequate, but may be increased by washing with a little 10–60% H_2SO_4 solution. Experiments have been made on all types of cracked gasoline containing up to 0·26% mercaptan sulphur, all having been successfully sweetened. Separation of the two phases presents no difficulty, the alcohol remaining in the gasoline being completely removed by tenfold dilution with water. The alkali by-products show traces of sodium polysulphide, free caustic soda and large proportions of Na_2S or $Na_2S_2O_3.5H_2O$, being entirely free from mercaptans. Recovery of the latter two products should be profitable.

The reagents should be reasonably free from water, excess in the alcoholic solution markedly lowering its efficiency. The alcohol can be substantially recovered by re-using the final washing water, followed by distillation. Loss of alcohol should not exceed 0·1–0·2%, whilst the cost of recovering alcohol should not be greater than 0·5 c. gln. Further tests on the use of sulphur and alcoholic solution of ammonia were unsuccessful. The replacement of elementary sulphur by an alkali polysulphide was also unsuccessful. Comparative tests with a normal doctor sweetening treatment gave similar results. The cost of treatment by the new process is given as 0·561 c. per brl., to which should be credited a saving of 0·5–1·0% of gasoline over normal doctor treating. At 6 cents per gallon this saving amounts to 1·25 to 2·50 c. per brl. of gasoline treated; further, the alkali by-products should have a definite commercial value. C. L. G.

835. Motor Benzole Refining. W. H. Hoffert and G. Claxton. *Gas World*, 1935, **102**, Cooking Section, 53–56.—A summary is given of the significance of the various properties of motor benzole and an account of modern developments in refining this product. C. C.

836. Selective Solvents in Lubricating Oil Refinery. Bandte. *Oel und Köhle*, 1935, **11**, 251.—The requirements and evaluation of extraction solvents are described, and a table is given of the chief physical properties of solvents in common use. The efficiencies of these solvents, judged by yield and viscosity index, when applied to a number of American lubricating oils, are tabulated. P. G. H.

837. Solvent Extraction of Petroleum Fractions. J. Dickinson. *Oil & Gas J.*, 9.5.35, **33** (51), 16.—According to the best information there are operating, building and authorized in U.S.A. a total of 22 solvent extraction plants with a charging capacity

of 45,000 brl. a day. Assuming a yield of 60% after finishing treatments, the daily production of lubricating oil from these plants will be about 27,000 brl. The total daily production of lubricating oils in the U.S.A. in 1934 was 72,300, of which 28,700 were used for motor lubricants, 22,000 for industrial and general purposes, and 22,500 exported. Thus the present projected output of solvent extracted oils approaches closely the domestic consumption of motor oils. It is of interest to note that many Pennsylvania refiners are adopting the process.

Of the solvents commercially used, anhydrous phenol, now applied in four plants, has the advantage over most others in requiring a comparatively low ratio of solvent to oil and in giving a greater improvement in colour and carbon residue for an oil of given viscosity index. The recent application of water as an additional agent to the extract before removal from the system also results in larger yields than with most other solvents, since aqueous phenol is a poor solvent for paraffinic oils, thus preventing any serious loss of oil of high V.I. to the extract.

The most compact and truly countercurrent system is the packed column, and with the use of Raschig rings a tower equivalent to six or seven stages can be of practical height. As in the bubble tower in distillation, maximum yield from such a column will depend on refluxing, and the reflux should be solvent-free extract. By so doing the solvent is prevented from leaving the system in equilibrium with the oil feed, but is made to leave in equilibrium with a more naphthenic material. A method for refluxing the bottom of the column (*i.e.* oil inlet) with solvent-free extract is shown diagrammatically. Such a method, by suitable adjustment of solvent/reflux ratio, can be made to give increased yields of a given quality of raffinate. Other methods of obtaining reflux are changing character of solvent by decreasing temperature, adding a modifying component (*e.g.* water to phenol), changing the distribution by adding a third component to the system which will form an upper layer of more paraffinic components (*e.g.* use of propane for washing). R. A. E.

838. Application of the "Chlorex" Process to Pennsylvanian Lubricating Oil. D. B. Williams. *Nat. Petr. News*, 1.5.35, **27** (18), 26.—The author discusses the details, costs, and results of applying the solvent extraction process to Pennsylvanian oil using ββ-dichloroethyl ether (Chlorex) as the selective solvent. The plant is of the four-stage counter-flow type and operates at temperatures ranging from 60 to 125° F. Extraction loss amounts to 5–10% volume of the oil processed. Data given show that treated oils have higher viscosity indexes, better colour, lower acidity and carbon residue. The most important improvement is claimed to be in the increased resistance of treated oils to oxidation and sludging as judged by the Sligh and the Indiana Oxidation tests. Percolation yields in the clay-contacting process are increased by some 25%. The solvent is recovered continuously in the plant with a loss of only 0·04% volume, and the total cost of the process is given as 0·4–0·5 c. per gallon. Up to date the extract is used only for cracking processes or as fuel, but work at present in progress indicates the promising probability of a more economical method of disposal. H. G.

839. Manufacture, Packaging and Shipping of Oxidized Asphalts. (Article 3.) C. J. Holland. *Petr. Eng.*, April 1935, **6** (7), 39.—A description with operating details and drawings is given of a blown asphalt plant consisting of twenty-four batch stills, 10 ft. in diameter and in height forming three batteries, with a capacity of 54,000 tons of finished products per year. The charging stock was Texas asphaltic residue of 12–14° B. at a temperature of 200° F., the first three stills being fired rapidly to oxidizing temperature, the remaining five being heated by the exothermic heat of the reaction, except under special conditions. The consumption of compressed air was 750 cubic ft. per ton of asphalt, the low consumption being accounted for by (*a*) the use of mechanical agitation, (*b*) continuous operation, and (*c*) use of vertical stills. Stills were cleaned on an average twice monthly, the last stills being the heaviest to clean, one day being required on an average for cooling and one for cleaning. The blown asphalt is filled into six receiving pans, 25 ft. by 30 ft. by 6 ft. divided into two compartments each holding 67 tons; each battery filling a compartment per day in turn. The receiving pans are fitted for light firing when dealing with the harder grades. A special quick-opening steam-heated valve permits the filling of a drum in 30 secs. or less.

A description of the package, filling, cooling and storage sheds is given. Using a simple type of waggonette for handling the drums, a compartment could be emptied in 2½ hrs. at a cost of 40 cents per ton. The temperature of the asphalt in the pans

corresponds to 10–15° above the melting point. To allow for contraction on cooling, a special removable ring is fixed round the top of the drum, allowing the drum to be filled to 110–115% of its capacity. The rings are dipped in lime water or clay to allow of their easy removal. C. L. G.

840. Manufacture, Packaging and Shipping of Oxidized Asphalts. (Article 4.) C. J. Holland. *Petr. Eng.*, May 1935, **6** (8), 40.—A description is given of another blown asphalt refinery, with details of stills, compressed-air plant, vapour disposal system and packaging equipment. The plant consists of thirty-one horizontal batch stills, 9 ft. in diameter and 40 ft. long, of total capacity 360,000 tons of asphaltic products p.a. A wide variety of charging stock is used, and seventy varieties of products are made, including steam-refined, air-blown, cutbacks and emulsified types. The air consumption varies from 1300 to 1800 cu. ft. per brl. of charging stock, being supplied by centrifugal air blowers.

Conversion from batch to continuous operation has not taken place owing to the stills being horizontally placed and to the variable requirements from the plant. Change is, however, being made to the blending of requirements from a small number of base materials. Improvements in the efficiency of oxidation have been made by reducing the total cross-sectional area of the air spider perforations from five-fourths to two-thirds of that of the air feed-pipe. In consequence, the air outlet is more uniform; and the air bubbles are compressed so that they expand as they rise through the hot liquid, making better and quicker contact. The frequency of spider cleaning is reduced by careful steaming out after pumping a batch of finished products.

The ordinary safety-valves are substituted by two circular-spring-actuated explosion hatches about 2 ft. in diameter, which relieve any excess pressure directly to the atmosphere. The oxidized vapours are passed into vapour scrubbing drums lined with gunnite, fitted with baffle trays over which water flows, and the washed vapours passed to a concrete stack. The oil and water flows to the refinery sewage and drainage system and thence to the oil trap. The stills are cleaned after every run when making products of 300° m. pt. and after eight or twelve batches while making products of 180–250° m. pt. Oxidation losses average 5%, being 5–7% for products around 300° m. pt. and 2–3% for products around 100° m. pt. The value of building vertical stills with small diameter-height ratio was illustrated by the lack of increase in capacity given by filling the converter to 2½ ft. instead of 7 ft. The greater amount of foaming during oxidation caused the additional 6 inches of charge to be lost by entrainment in the vapours. Filling is effected from cylindrical horizontal tanks under 30 lb. air pressure. The storage tanks are from 1000 brl. to 10,000 brl. capacity, and are lined on the outside with hollow tile insulation and heated by internal steam coils. Mineral rubber or asphalts of 300–350° m. pt. are transferred by steam pressure through wire screen bucket filters to the filling tanks. Packaging is usually done in iron drums, although wooden barrels are also used. The plain-edged staves were found quite as satisfactory as the more expensive tongue-and-groove staves. Substitution of wooden hoops by vertically corrugated-iron wire was found to give a tighter package at less cost. The drums are clay washed internally to prevent the asphalt sticking. C. L. G.

841. Synthetic Lubricants. F. C. Hall. *Oil & Gas J.*, 28.3.35, **33** (45), 81.—With the present trend in automobile and aircraft design towards ever-increasing efficiency an increasing demand for lubricating oils of superior characteristics to those which can at present be obtained in straight petroleum lubricants is indicated. Previous workers have shown that important factors, such as viscosity index, pour-point, carbon formation, sludge tendency and perhaps oiliness, can be controlled to certain extents by the use of or admixture of synthetic oils.

For the production of lubricating oils catalytic polymerization offers the widest possibilities, and of the catalytic materials available metallic halides, notably aluminium chloride, appear most active. The work of various investigators shows that normal olefins provide the best base material and that V.I. improves with increase in the number of carbon atoms. Reference is also made to Exanol and to the use of boron trifluoride and ferric and zinc chlorides. Investigations carried out in connection with (*a*) chlorination and dechlorination reactions, (*b*) dehydrogenation reactions, (*c*) condensation compounds, (*d*) hydrogenation of tars and petroleum oils, (*e*) low-temperature carbonization, in regard to lubricating oil production are summarized and commented upon. R. A. E.

842. Disposal of Refinery Wastes. Section III. Waste Water Containing Solutes. A.P.I. Pamphlet 1935.—The solutes occurring in refinery waste waters are classified and their sources discussed. Recommendations of good practice for the disposal of waste water containing these solutes are given. Appendices to the report cover the properties of solutes, the origin and control of mineral acidity and alkalinity, H_2S and sulphide solutes, oxygen consuming compounds, the question of taste and odour in refinery waste water and the effect and control of the total solids content.

Refinery solutes includes (1) those originating from petroleum, either naturally or as decomposition products, (2) those derived from treating agents, (3) those derived from treating agents in combination with petroleum products, (4) miscellaneous soluble substances and (5) those present in the water supply. The possible solutes originating from the different refinery processes are discussed and their properties outlined and the necessity of proper control over refinery effluents is emphasized.

C. L. G.

843. Metallizing in Prevention of Corrosion in Refineries. H. R. Leland. *Oil & Gas J.*, 28.3.35, **33** (45), 99.—A survey is given of recent developments in the process of metallization, method of application, equipment required and work carried out for refiners. Metallizing is accomplished by spraying metal at a high temperature upon the surface, the heating being done by a reducing flame, and the metal fed into the sprayer in the form of wire. A large number of metals can be treated by this method, aluminium being the most favoured for the internal lining of refinery equipment subject to heat and corrosion. The formation of blisters on metallized surfaces can be minimized by carefully removing the oil from the porous sections of the metal (particularly the welds) by means of a torch. The use of a baffle to prevent the oil striking the lining of a bubble tower under too great a pressure will prevent erosion which results in wear and streaks in the lining.

The use of a fairly thick aluminium lining (*e.g.* 0·018 in. thick) for reaction chambers is recommended. Although the coating is liable to be attacked by chlorides at temperatures of 500–550° F., requiring repairs every six months, such coatings provide economical protection. The protection of radiant tubes by aluminium metallization has not yet been satisfactorily solved. Cases of almost complete protection of reaction chambers by aluminium linings are described. Hot oil-pump plungers have been successfully rebuilt by coating with KA25 steel. When an exceptionally hard surface is required, coating with an extra high carbon steel wire is recommended. The initial cost of metallizing and high-pressure equipment is no greater than that of ganister, as only those parts of the equipment needing protection are actually covered with aluminium. The aluminium does not spall to foul the valves nor does it have to be removed for inspection. Repairs are inexpensive and the time off-stream for inspection is reduced appreciably. In the smaller reaction chambers, the lower loss of diameter, due to the thin metal lining as compared with a ganister lining, may result in higher octane values being obtained in the cracked gasoline. C. L. G.

844. Development of Manganese–Molybdenum Steel for Valves and Fittings for the Oil Industry. A. C. Gregg. *Petr. Eng.*, May 1935, **6** (8), 112.—Increasingly severe demands on the strength of valves and fittings for the oil industry has led to the evolution of alloy steels from the cast iron, semi steels and cast steels used previously. The ductility of cast iron and semi steel is almost nil, whilst the strength and shock resistance are very low. Ordinary cast steel has 3 to 4 times the tensile strength of cast iron and twice that of the semi steel of 15 years ago, and 15 to 20 times the shock resistance of either metal. Data are presented on the physical properties and structures of 0·30 carbon cast steel in four typical conditions:—A as cast, B fully annealed, C normalized and tempered and D quenched and tempered, illustrating the improved properties of the D type. Improvements in ductility and resistance to wear and abrasion are given by alloy steels, as compared with the carbon cast steels, the alloys in general use for the production of pearlitic and sorbitic alloy steels being Ni, Mo, Cr, Va and Mn.

Further data are presented on the physical properties and structures of cast Mn–Mo steel in the same typical conditions as for carbon cast steel. The practical limits for hardness in a carbon steel valve lie between 150 and 180 on the Brinell scale (representing a tensile strength of 75,000–90,000 lb. per sq. in.), whereas that for the heat-treated Mn–Mo steel is 200–225 Brinell (representing a tensile strength of 100,000 and 110,000 lb. per sq. in.). Resistance to shock at the above tensile strengths is 40–42 ft.-lb. Izod for the carbon cast steel and 54 ft.-lb. Izod for the Mn–Mo steel.

The unusual combination of high tensile strength and shock resistance of the Mn–Mo alloy steel renders it ideal for the manufacture of valves and fittings. As compared with Cr or Ni or Cr Ni steel, it is less likely to contain checks and internal tears and shrinkage defects not discernible by surface inspection. Owing to the fact that Mo does not oxidize during melting and refining, the Mo content can be easily controlled.

Improvements in the material used for valve manufacture has been concurrent with improvements in workmanship in the foundry and machine shop. C. L. G.

845. Refinery Steam Chart. W. F. Schaphorst. *Petr. Eng.*, April 1935, **6** (7), 38.—A chart is reproduced enabling calculations to be made regarding steam flow, steam pressure, and diameter of opening or diameter of short pipe for given conditions where there is at least 60% pressure drop through the opening. Examples are given of the use of this chart for solving heating problems and its value in estimating the loss of steam through leakage described. C. L. G.

846. Patents on Hydrogenation. Int. Hydn. Patents Co. E.P. 427,275, 18.4.35. Hydrogenation of solid carbonaceous materials previously impregnated with a solution of a catalyst in an organic solvent. The latter may be organic acids or their anhydrides, amino-acids, ketonic acids, acid amides, acid chlorides, esters, alcohols, ketones, aldehydes, nitriles, amines, nitro-compounds and ethers.

Carbide and Carbon Chem. Corpn. E.P. 427,368, 23.4.35. Preparation of hydrogenation products of α-ethyl β-propylacrolein (*e.g.* α-ethyl-hexaldehyde, 2-ethyl-1-hexanol and *n*-heptane) by treatment with hydrogen in the presence of catalysts at normal or elevated temperatures and pressures.

Int. Hydn. Pats. Co. E.P. 427,435, 24.4.35. Apparatus for hydrogenation in which those parts which attain a temperature between 200° and 350° C. are internally coated with a thin lining of tantalum or its alloys.

Int. Hydn. Pats. Co. E.P. 427,632, 23.4.35. Motor fuels are stabilized with regard to gum formation by catalytic vapour-phase hydrogenation at 200–400° C. and 1–30 atm. The catalyst is molybdenum disulphide.

I.C.I. E.P. 427,883, 29.4.35. Destructive hydrogenation of carbonaceous materials containing ash of basic nature, a hydrogen halide being introduced into the system in order to neutralize the ash.

Int. Hydn. Pats. Co. E.P. 427,905, 2.5.35. Production of motor fuel from hydrocarbon mixtures containing a high proportion of aromatics. The initial material is distilled into a light and a heavy fraction (b. pt. 150–240° C.); the former is refined by normal chemical means and the latter hydrogenated at 300–390° C. and 200 atm. in the presence of catalysts (Sn, V, Mn, Ti, Zr, Zn, Cd, Al, Co).

G. F. Jaubert. E.P. 427,967, 30.4.35. Preparation of hydrogen under pressure by the reaction of powdered silicon or silicon alloys with caustic soda and water.

A. Vonk. E.P. 428,217, 3.5.35. Hydrogenation of petroleum in the vapour phase, in which the gas mixture is passed through a purifier for eliminating the sulphur content, the purifier containing in the direction of vapour flow, iron, copper and nickel. The purified vapours are then passed over a hydrogenating catalyst (nickel, vanadium and cobalt).

A. J. Kling and J. M. Florentin. U.S.P. 1,999,363, 30.4.35. Conversion of phenols into aromatic hydrocarbons by vapour phase hydrogenation at 10 kg./sq. cm. and 400° C. in the presence of a catalyst comprising alumina and molybdenum oxide, or oxides of molybdenum and tungsten, etc.

P. Herold and H. Kaufmann. U.S.P. 2,002,997, 28.5.35. Hydrogenation of carbonaceous materials at 300–700° C. and above 20 atm. in the presence of catalysts consisting of isopoly acids and complex acids of molybdenum and tungsten and the salts of these acids. W. H. T.

847. Patents on Gas. Machin. App. Fab. "Meaf." E.P. 427,598, 26.4.35. Aromatic hydrocarbons are recovered from wash oil by heating the latter and then fractionally condensing the vapours, thereby obtaining a number of fractions, the main one of which is suitable as motor benzole.

S. H. White. E.P. 427,624, 24.4.35. A gaseous fuel for use in an oxy-hydrogen blow-pipe is obtained by adding 2–10% of propane to a combustible gas mixture (*e.g.* coal gas, Mond gas, producer gas, water gas, etc.). The addition retards the rate of flame propagation and makes good the deficiency of hydrogen in the gas mixture.

I.G. Farbenind. A.-G. E.P. 427,394, 15.4.35. Weak gaseous acids (CO_2 and H_2S) are removed from gas mixtures by scrubbing with an organic base, *i.e.* mono-ethanolamine containing 3% boric acid. The spent medium is regenerated by heating.

H. Dreyfus. E.P. 427,798, 26.4.35. Preparation of unsaturated gases by reacting carbon with methane and/or hydrogen at above 1000° C. Heat is supplied to the reactants by burning methane or hydrogen within the reaction zone during the reaction.

Distillers Co. E.P. 428,106, 7.5.35. Removal of olefines from gas mixtures by absorption in a solution of a cuprous salt in an aqueous hydroxy-alkylamine.

W. G. Whitman. U.S.P. 2,001,996, 21.5.35. Normally gaseous hydrocarbons are maintained in liquid form at atmospheric pressure by refrigeration. Vapours evolved during storage are cooled, liquefied and refrigerated and returned to the main bulk of material.

E. R. Cox. U.S.P. 2,002,340, 21.5.35. Absorption of gasoline from natural gas, in which the lighter constituents are removed in the early stages so that only the desired stable gasoline is contained in the absorption liquid.

P. K. Frolich. U.S.P. 2,002,534, 28.5.35. Production of normally liquid hydrocarbons from gaseous materials by cracking to yield unsaturateds and free hydrogen. An oxide of carbon is added to the mixture and reacts with the hydrogen, the unsaturated hydrocarbons being then polymerized. W. H. T.

E. Haber. D.R.P. 601,502, 17.7.32. Separation of solid or fluid constituents from gases.

Siemens, Schuckert. D.R.P. 602,922, 19.9.34. SO_2 is extracted from gases by cooling and electrofiltration.

Maschinenfabrik. D.R.P. 608,844, 19.9.33. The sealing fluid for gas holders is circulated and enriched by the benzole-containing gas. By heating the fluid to at least 70–90° C., vaporization of the absorbed benzole back into the gas is effected.

I. Bronn-Concordia Bergbau. D.R.P. 609,586, 15.10.33. A liquefied gas for motors, consisting mainly of methane and ethylene. The gas, compressed to 10–100 atm., is released to about 1 atm. before entrance to the mixing valve, and is also preheated to 50–100° C.

Mapag. D.R.P. 610,503, 5.10.33. A process for the distillation of liquefied gas mixtures.

N.V. Machinericen App. Fab. D.R.P. 612,438, 26.1.34. Extraction of volatile matter from gases.

I.G. Farbenind. A.-G. D.R.P. 611,113, 15.7.30. Extraction of ethylene from gases and vapours by means of the electric arc.

H. Koppers. D.R.P. 611,618, 10.9.31. Desulphurization of gas by means of As-o-compounds.

A.-G. Indust. Verwertung. D.R.P. 611,695, 13.3.33. Plant for the delivery of liquefied gas.

I.G. Farbenind. A.-G. D.R.P. 612,206, 5.12.29. Removal of acetylene from gaseous olefines by treatment with hydrogen at 250° C. in the presence of a catalyst comprising chromium or nickel compounds. L. S.

848. Patents on Crude Oil. C. H. M. Roberts. U.S.P. 2,000,717, 7.5.35. A demulsifying agent for breaking emulsions. It consists of a substituted polyhydric alcohol in which at least one hydroxyl group is replaced by a polybasic carboxy acid body.

J. C. Walker. U.S.P. 2,000,725, 7.5.35. Emulsions are broken by the addition of sulpho-oleic acid, oleic acid and stearolactone.

J. C. Walker. U.S.P. 2,000,802, 7.5.35. A demulsifying agent comprising a mixture of reaction products resulting from the sulphonation of equal proportions of benzene and oleic acid. W. H. T.

849. Patents on Motor Spirit. D. Zimmermann. E.P. 426,793, 9.4.35. Apparatus for the removal of water from motor spirit. The water is partly eliminated by capillary attraction by means of one or more rods and completely by passage of the fuel through a layer of anhydrous salt (NaCl, Na_2SO_3, $CaCl_2$, etc.).

R. B. Day. U.S.P. 2,001,185, 14.5.35. Hydrocarbon vapours are refined by adding hydrogen chloride and steam and bringing the mixture into contact with an aqueous solution of the chloride of a metal (zinc chloride) the sulphide of which is soluble in hydrochloric acid. The solution contains a reactive compound (copper

oxide) having the character and action of the chlorides and oxides of the metals the sulphides of which are substantially insoluble in hydrochloric acid.

D. R. Stevens and W. A. Gruse. U.S.P. 2,001,634, 14.5.35. Treatment of distillates at 65–480° C. with small proportions of a mixture of anhydrous aluminium chloride and an added organic moderating agent (phenol) which restrains the activity of the aluminium chloride.

V. Ipatieff. U.S.P. 2,001,906, 21.5.35. Production of high anti-knock motor fuel by subjecting a mixture of straight-run spirit, gasoline and cracked gases to the action of sulphuric acid. Olefines contained in the gases are reacted with a portion of the distillate to form alkylated derivatives of high anti-knock rating.

V. Ipatieff. U.S.P. 2,001,907, 21.5.35. Anti-knock motor fuel is obtained by pyrolytic conversion of distillates, thereby forming condensable aromatics and gaseous olefines which are reacted with sulphuric acid to form alkylated derivatives.

V. Ipatieff. U.S.P. 2,001,908, 21.5.35. Cracked gases are treated with acid sludge and a high anti-knock motor fuel is obtained.

V. Ipatieff. U.S.P. 2,001,909 and 10, 21.5.35. Aromatic hydrocarbons or straight-run spirit and cracked gases are converted to anti-knock fuels by treatment with sulphuric acid sludge.

C. R. Payne and D. R. Stevens. U.S.P. 2,002,250, 21.5.35. Cracked gasoline is refined by treatment with 0·5–3% by wt. of aluminium chloride at 400° C. and 1–2000 lb. per sq. in. pressure for a period of 20 minutes.

F. E. Frey. U.S.P. 2,002,394, 21.5.35. Low-boiling saturated hydrocarbons (butane) are converted to higher-boiling material by pyrolysis at decomposition temperature and 1000 lb. per sq. in. in admixture with 10% of olefins.

J. C. Morrell. U.S.P. 2,002,747, 28.5.35. Cracked oil is refined in the vapour phase by passage through molten alkali or alkaline earth metal together with ammonia.

S. M. Martin and W. A. Gruse. U.S.P. 2,002,902, 28.5.35. A process for removing gum and gum-forming constituents from cracked distillates. Fractions of boiling range: 155–175° F., 205–225° F. and 255–275° F. are obtained, the gum and gum-forming constituents are removed and the treated material is blended back with the main distillate. W. H. T.

850. Patents on Kerosine. Ehrich and Graetz A.-G. E.P. 426,921, 11.4.35. A blue-flame petroleum burner in which regulation of flame size is effected solely by adjustment of the wick. It has a combustion space formed by perforated walls and a wick sheath the upper end of which is widened and provided with air holes. The perforated side-walls of the widened part of the wick sheath extend vertically.

Lampen und Metall., A.-G. E.P. 428,022, 3.5.35. A wick burner having a combustion chamber arranged above the wick and formed by removable perforated sleeves. A device is provided for throttling the air entering the chamber surrounding the vapour-developing portion of the wick, the air, with the vapours, then entering the bottom of the combustion chamber.

Coleman Export Corpn. E.P. 427,465, 18.4.35. A fuel burning device is described which comprises a tank to contain the fuel and air under pressure, a fuel conduit and valve and an air-passage-way discharging into the fuel conduit. The air-passage-way is of sufficiently small cross-section to cause frictional retardation of the air when the fuel valve is initially opened. This allows the air-pressure on the liquid to be momentarily greater than in the air-passage-way, and thus ensures that the liquid is raised to the burner.

Perry Barr Metal Co., Ltd. E.P. 427,825, 1.5.35. Improvements are described relating to a gland and mounting for a pricker rod in a vaporizer tube of a liquid fuel lamp. A trap is provided in the gland, together with a plurality of drain passages leading to the supply tank.

Ehrich and Graetz A.-G. E.P. 427,889, 23.4.35. A bunsen-burner fed with liquid fuel by a periodically working thermal delivering device. The air space above the fuel ensures an even oil-delivery pressure by being kept warm with heat transmitted from the burner without heating the inlet end of the vaporizer. W. H. T.

851. Patents on Lubricating Oil. A. Duckham. E.P. 426,755, 9.4.35. An engine lubricant composed of a combination of low-melting mineral waxes with esters of mono- and di-hydric alcohols in which is incorporated zinc oxide and/or zinc; or cadmium oxide and/or cadmium.

Edeleanu Ges. E.P. 426,764, 9.4.35. A process for the removal of solvents from oils in which the high-boiling components of the solvent are stripped with vapours of the low-boiling part of the solvent. The latter is freed from high-boiling components before being reintroduced into the system.

Akt. Separator-Nobel. E.P. 426,920, 11.4.35. A two-stage centrifugal process for the removal of wax from chilled oil-wax mixtures. The centrifuge bowls used for the first stage are regulated so that a wax-free oil and a concentrate of solid hydrocarbons of low viscosity are produced. The concentrate is then centrifuged in the second stage to produce a material rich in solid hydrocarbons.

J. J. Johnson. E.P. 427,042, 15.4.35. Lubricating oils are prepared from solid carbonaceous materials by destructive hydrogenation. The liquid product is distilled to yield a residue boiling above 350° C. which is treated at below 200° C. with alcoholic solutions of alkaline reagents. The fraction remaining undissolved in the reagent is refined by a solvent-extraction process.

Irma Ind. Ruwmat Mij. E.P. 428,179, 8.5.35. A lubricating inter-layer for insertion between surfaces which would otherwise be in frictional resistance (*i.e.* leaf springs). It consists of a hardened mixture of asbestos, graphite and synthetic resins.

Standard Oil Dev. Co. E.P. 428,438, 13.5.35. A material for blending with lubricating oil, etc., in order to improve viscosity index. It consists of a resinous material prepared from synthetic, non-oxygenated resin containing reactive aromatic nuclei. W. H. T.

I.G. Farbenind. A.-G. D.R.P. 612,717, 16.5.31. Mineral, vegetable and animal oils are improved by the addition of 0·01–0·5% of perylene. L. S.

J. E. Schulze. U.S.P. 1,999,212, 30.4.35. Production of straight overhead paraffin base lubricating oil distillate by high vacuum distillation at an absolute pressure of 25 mm. of mercury without acid treatment or filtration.

H. G. Smith. U.S.P. 1,999,486, 30.4.35. Manufacture of heavy lubricating oils by dewaxing mixtures in suitable proportions of wax-containing overhead fractions and residual stock capable of centrifugal treatment and dewaxing the mixture by centrifuging.

C. F. Tears. U.S.P. 2,000,427, 7.5.35. Production of wax of high-melting point by propane dewaxing.

L. A. Clarke. U.S.P. 2,000,690, 7.5.35. Solvent extraction of lubricating oil using an aryl acyl derivative of furan, *e.g.* benzoyl, toluyl and xyloyl furan.

R. E. Manley. U.S.P. 2,000,707, 7.5.35. Improvement in the solvent extraction of lubricating oils using furfural, consisting of recovering the furfural by heating the furfural and oil in admixture with water to a temperature of 275–325° F. The oily constituents are removed at this temperature and the remaining mixture is cooled to separate and recover the furfural.

E. W. Gard. U.S.P. 2,002,004, 21.5.35. Production of lubricating oil by solvent extraction using liquid propane.

D. R. Merrill and P. Subkow. U.S.P. 2,002,702, 28.5.35. Multi-stage solvent extraction of lubricating oils using liquid sulphur dioxide, selenium oxychloride, aniline, nitrobenzene, ββ′-dichlorethylether, furfural or mixtures thereof.

H. T. Bennett. U.S.P. 2,003,233–9 inclusive, 28.5.35. Production of lubricating oils of high viscosity indices from those of low viscosity indices using halogenated ether. W. S. E. C.

852. Patents on Fuel Oil. J. L. Strevens and K. G. S. Hatfield. E.P. 426,732, 9.4.35. Coal–oil mixtures are prepared by grinding the solid fuel to coarse colloidal dimensions in the presence of high-boiling oil and 0·5–1·0% (on the weight of coal) of vulcanized or unvulcanized rubber. W. H. T.

Ges. f. Teerverwertung. D.R.P. 612,810, 24.12.29. Fuel oil is produced from coal tar by boiling the tar or its fractions, mixed with aliphatic hydrocarbons (gas oils) under reflux for a prolonged period, after which asphaltic substances are separated and the mixture refined.

853. Patents on Asphalt. H. W. Kunze. E.P. 426,844, 10.4.35. Asphalt is obtained from acid sludge by heating to 160–180° C. and maintaining the material at this temperature under a pressure of 10–25 atm. for about 2 hrs. The pressure is then

gradually reduced with simultaneous reduction of temperature to about 70° C., after which asphalt and sulphuric acid are separated.

F. Jacobsohn. E.P. 427,777, 30.4.35. Tar–bitumen mixtures are produced by air blowing the mixture at 130° C. in the presence of sulphuric acid (up to 3%) with the addition of oxidizing substances such as persulphate, perborate, etc.

C. A. Agthe. E.P. 428,334, 10.5.35. A process for surfacing roads, etc., with bitumen, in which a pre-coating is applied which consists of a high-boiling oil mixed with pitch, asphalt, resin or wax.

E. B. McConnell. U.S.P. 2,002,670, 28.5.35. Oxidized asphalt is prepared by forcing hot petroleum residue through capillary openings and passing the finely-divided residue countercurrent to air. W. H. T.

854. Patents on Special Products. Soc. Franc. Carbon. et Dérivés. E.P. 427,396, 15.4.35. A process for the production of carbon by decomposition of carbon monoxide in the presence of a catalyst.

I.G. Farbenind. A.-G. E.P. 427,903, 2.5.35. Organic sulphur compounds are prepared by the reaction of acetylene at 50–300° C. with a mercaptan of the aliphatic, aromatic or heterocyclic series, in the presence of a basic metal compound or of a salt of zinc or cadmium with an organic acid as catalyst. W. H. T.

Standard Oil Development Co. E.P. 428,410, 13.5.35. Improvement of petroleum hydrocarbons, *e.g.* gasoline, kerosine, diesel fuel oil, lubricating oil and solid waxes, by blending them with a viscous liquid or solid hydrocarbon polymer of high molecular wt. obtained by the condensation of a saturated dihalo derivative of an aliphatic cyclic hydrocarbon containing less than 5 carbon atoms, *e.g.* ethylene dichloride.

Kinetic Chemicals Inc. E.P. 428,361, 7.5.35. Fluorination of hydrocarbons such as acyclic or aryl derivatives, by treating them with hydrofluoric acid in the presence of a catalyst, *e.g.* a halide of copper, silver, gold, zinc, cadmium, mercury, vanadium, manganese, iron, cobalt, nickel or platinum dispersed on carbon. W. S. E. C.

Sharples Solvent Corpn. D.R.P. 607,461, 30.10.31. Chlorination of gaseous saturated aliphatic hydrocarbons containing more than two carbon atoms to avoid explosion by passing a stream of chlorine into a considerable molecular excess of the hydrocarbon at a rate which is greater than the critical velocity at which ignition would occur.

I. Davidsohn and R. Strauss. D.R.P. 608,973, 11.11.33. Production of castor oil which is soluble in mineral oil by mixing it in determined proportions with highly chlorinated high-molecular aliphatic hydrocarbons.

I. G. W. Sommer, H. Weissbach and L. Reinhardt. D.R.P. 609,162, 25.3.30. Mixtures of paraffin, ceresin, ozokerite, etc., as produced by oxidation and esterification of montan wax are claimed to be very useful for coating or impregnating acid-containing vessels. L. S.

855. Patents on Cracking. E. Bluemner. E.P. 427,558, 26.4.35. Heavy oil, tar, etc., is cracked in an externally heated container fitted with an insert vessel. The annular space thus formed is used for preheating the cracking stock.

E. W. Brocklebank. E.P. 427,960, 23.4.35. Coal–oil mixtures are distilled by heating at above 500° C. in an inclined externally heated cylindrical rotating retort. A high-boiling fraction of the distillate is blended with a viscosity-reducing oil and the mixture employed in the preparation of the coal–oil mixture.

C. Still. E.P. 428,108, 7.5.35. A process for cracking primary coal and lignite tars. The heated products are passed through an expansion jet and strike a baffle plate over which the cracking stock flows and is distilled by the heat of the cracked products.

G. Armistead and W. T. Donaldson. U.S.P. 1,999,270, 30.4.35. A combined topping and cracking system in which the charge stock is brought into contact with the hot cracked products.

G. B. Murphy. U.S.P. 2,000,186, 7.5.35. A liquid phase process in which oil is cracked under pressure in a tube heater, the velocity being kept high in order to minimize coke formation.

C. W. Luton and J. Beddow. U.S.P. 2,000,399, 7.5.35. Cracking plant in which reflux condensate is introduced at definite levels in the reaction chamber. The reflux condensate may be replaced by a similar oil of lower boiling characteristics such as P.D. bottoms, kerosine or light gas oil.

O. C. Brewster, M. G. Paulus and A. E. Thompson. U.S.P. 2,000,687, 7.5.35. A pressure distillation of the tube and tank type, the tubes being inclined and connected to headers communicating with a horizontal cylindrical shell still.

A. Joseph. U.S.P. 2,000,960, 14.5.35. Catalytic cracking in the presence of steam.

R. Cross. U.S.P. Re. 19,568, 14.5.35. A liquid-phase process for the production of a synthetic crude, with improved methods of dephlegmation and recycling of reflux condensate.

E. F. Nelson. U.S.P. 2,001,150, 14.5.35. A process in which cracked products are brought into direct or indirect contact with the reflux condensate in order to reboil the latter and strip light cracked products therefrom.

J. D. Seguy. U.S.P. 2,001,159, 14.5.35. A liquid-phase process, the stock being reflux condensate and light products derived from a primary distillation of heavy residual oil.

C. P. Dubbs. U.S.P. 2,001,187, 14.5.35. A process in which the time of cracking is controlled by suitable cooling of the cracked products in order to minimize coke formation.

H. L. Pelzer. U.S.P. 2,001,214, 14.5.35. A vapour-phase cracking process in which the cracked products are brought into intimate contact with an oil to be reduced to coke. A special design of valve is described for transferring the cracked vapours into the heavy oil without clogging the valve with tar or making it inoperative.

L. de Florez. U.S.P. 2,001,301, 14.5.35. Charging stock is distilled to give a clean distillate whose suitability as cracking stock is gauged by its depth of colour.

H. L. Pelzer. U.S.P. 2,001,313–4, 14.5.35. Cracking of sulphurous oil in which a desulphurizing agent is supplied to the stock in a state of fine dispersion.

G. Zotos. U.S.P. 2,001,444, 14.5.35. Mineral for oils are fed through a dephlegmating zone to a reactor. Steam at 200 atm. and 500° C. is passed through the reaction zone to the dephlegmator, condensed under pressure and used for the generation of further quantities of steam.

R. J. McRae. U.S.P. 2,001,741, 21.5.35. Cracking apparatus in which oil is circulated peripherally in a stationary annular chamber, the inner wall of which is a heating member. The velocity of the oil is such as to cause a higher pressure on the outside of the annular chamber and a film of vapour between the liquid and the inner wall.

J. Wyckliffe. U.S.P. 2,002,160, 21.5.35. Heavy oil is distilled; the distillate is cracked in the vapour phase and the residue subjected to a viscosity-breaking process. The products from both stages are combined and flashed at reduced pressure in a tower to yield a distillate and a fuel oil.

F. H. Edson. U.S.P. 2,002,530, 28.5.35. Improvements in recycling hydrocarbon oils during cracking operations.

M. L. Chappell. U.S.P. 2,002,729, 28.5.35. Cracked vapours are mixed with gas containing 5–18% of oxygen in quantities sufficient to reduce the hydrogen content of the vaporized oil to between 14·3 and 9% by weight. The mixture is passed through a reaction zone at 800–1300° C., vapours are separated and condensed and the residue mixed with that of the first stage of cracking.

L. de Florez. U.S.P. 2,003,137, 28.5.35. A two-stage cracking operation in which the condensate from the first stage is cracked at a relatively lower pressure but at higher temperature than those of the first stage. W. H. T.

856. Patents on Plant. Bat. Petm. Mij. E.P. 427,610, 26.4.35. Apparatus for bringing gases into contact with liquids. It comprises a column provided with sloping trays over which the liquid can flow and with means for passing vapour through the liquid. The latter may be conducted from a higher tray to a lower one or to a lower part of the column.

W. F. Wiltshire. E.P. 427,529, 25.4.35. Improvements in burners for liquid or colloidal fuel (described in E.P. 414,756).

Houdry Process Corpn. E.P. 428,416, 13.5.35. Catalytic conversion of hydrocarbon oil in which heat transfer means are provided to balance endothermic and exothermic reactions.

J. P. Bohan. U.S.P. 1,999,954, 30.4.35. A portable continuous distillation unit operated at low temperatures and pressures.

A. E. Krogh. U.S.P. 2,000,235, 7.5.35. An automatic control system for use with an oil-cracking unit.

R. K. Stratford. U.S.P. 2,000,672, 7.5.35. Apparatus for the continuous vapour-phase treatment of oil with clay.

F. O. Blair. U.S.P. 2,001,899, 21.5.35. A process and apparatus for the continuous acid treatment of pressure distillate.

G. B. Coubrough. U.S.P. 2,002,731, 28.5.35. Vacuum distillation of heavy oil with special means for removing cracked vapours. W. H. T.

E. Arpe. D.R.P. 607,461, 30.10.31. Mixing of fluids of different specific gravity is effected by sucking them off at the same time from different levels and jointly supplying to one or more mixing devices formed as jet aspirators which return the mixed fluids into the container. A float or similar apparatus is used for automatically maintaining the level of the mixing device.

Lolos Strainers, Ltd. D.R.P. 609,098, 8.7.32. A special filtering device fitted with rotatable purifying members.

Bloomfield Eng. Co. D.R.P. 611,396, 24.10.33. A frame construction for filter presses.

C. Still. D.R.P. 612,150, 27.1.34. The necessary amount of cooling water for light oil recovery plants is decreased by oil scrubbing the gases and thereafter distilling off the light oil from the enriched wash oil. The water-cooled portion from the light oil cooler is introduced into the cooling water conduits which lead to the spray cooler for the recovered wash oil.

C. Still. D.R.P. 612,959, 26.4.32. A device for cooling and separating distillate mixtures of oils, especially light oils with water. It comprises a separator for the warm condensate issuing from the separator which is fitted with cooling elements. L. S.

Class 700. Utilization.

857. Programme of Road Tests Inaugurated in California by Ethyl Corporation. E. Bartholomew and H. H. Dedo. *Oil & Gas J.*, 28.3.35, **33** (45), 66.—In order to add to its knowledge of the operation of engines under conditions differing from those at Detroit, the engineering laboratory of the Ethyl Gasoline Corporation is starting a series of tests at San Bernardino, Calif., where almost any desired combination of operating conditions can be set up. Roads in this area vary in elevation from approx. 200 ft. below to 7000 ft. above sea level. On one road elevation changes almost 6000 ft. in 35 miles, 12% grades occurring at some points. Another stretch of 12 miles is flat and smooth, permitting high sustained speeds. Four truck tractors, four automobiles and two farm tractors are to be used in the tests, and it is proposed to investigate: (1) Economy of high compression and high octane gasoline *v.* low compression and low octane gasoline in connection with heavily loaded trucks operating in mountainous country. (2) Relation of air–fuel ratio to fuel problems. (3) Effect of type and concentration of sulphur compounds on fuel behaviour in engines. (4) Effect on engine performance of lubricants added to gasoline. (5) Economy, performance and durability of farm tractors operated on distillate at low compression and on 70 octane gasoline at high compression. All vehicles are equipped with dual carburettors, gasoline pumps and tanks providing delivery of one type of fuel to one half of the cylinders and another fuel to the remaining cylinders. Special apparatus to check fuel consumption of each carburettor, to take exhaust gas samples, to vary manifold heat on tractor engines, and adjustable belt-driven water pumps to produce variable power absorption, will be provided. The vehicles have been tested on chassis dynamometers in the laboratories. Other equipment provided and problems to be investigated are described, and references made to difficulties met with in preliminary tests and to the methods employed to overcome them. R. A. E.

858. Development and Progress of the High-speed Diesel Engine in Road Transport. W. H. Goddard. *Diesel Engine Users Association*, 19.12.34.—The advantages the modern high-speed oil engine possesses over the gasoline engine are outlined and an indication is given as to how the early disadvantages have been overcome by improvements in design and materials.

Power output and fuel consumption curves are quoted for some of the leading

manufacturers' engines, and some idea is given as to the numbers of the various types that are in service.

The author discusses the relative merits of the open-combustion-chamber type and those types employing an additional chamber separated from the main cylinder. He believes that there is overwhelming evidence to show that the open-chamber engine is superior.

The one serious disadvantage remaining with the high-speed oil engine is stated to be that when it is allowed to get out of tune, the exhaust may become very smoky. The author emphasizes that users should insist on giving their engines the necessary attention and thus avoid this trouble. J. G. W.

859. Fuel Injection. C. B. Dicksee. *Aut. Eng.*, 1935, **25**, 91–97 and 131–132.—The author first reviews the average duties of the three main classes of diesel engines, viz. stationary, marine and vehicle, in order to illustrate the widely different sets of conditions to be met by the fuel injection apparatus. Descriptions of the three available types of injection mechanisms, viz. the Constant Pressure, the Spring Injection and the Direct Cam-operated Plunger, are also given, but the article is mainly confined to experimental data and problems arising when using the cam-operated type in engines for use in vehicles where the variations of duty are much greater than with any other type. It is unfortunate, from the engine designers' point of view, that no pump has yet been produced which enables the user to adjust its discharge characteristics to the engine to which it is to be fitted, especially at the higher end of the speed range. It is realized, of course, that the pump manufacturer cannot remedy inherent engine defects, but co-operation is greatly to be desired.

The authors give particulars of experiments carried out by varying the pump delivery valve lift and by its entire removal, and it would appear that this valve has probably a greater effect on the pump performance as regards the speed discharge curve than any other factor.

Experiments with varying lengths of fuel pipe are also described. Generally speaking, the longer the pipe the longer the delay in injection. Pressure waves in long fuel pipes, however, cause very complicated distortion, and if used on an engine with a wide speed range it becomes practically impossible to control conditions at all speeds. Sets of diagrams obtained at both ends of fuel lines of different lengths with a Farnboro indicator show the effects of wave motions on the pressures in the fuel line at different speeds.

In conclusion, the author states that although most of the experiments in this field to date have necessarily been of the " hit and miss " variety, much information has been gained, although at the moment nothing like absolute control of the fuel during injection can be claimed. C. H. S.

860. Wood Gas. H. List. *Z. Oesterr Ing. Arch.*, V., 1935, 104–108.—Wood gas researches are very important for Austria. By using wood gas, costs are decreased to between one-fifth and one-sixth of those for benzine. For a 4-ton Saurer freight truck formerly operated with benzine, a saving of 70·3% has been obtained. Only beechwood is used at present, and it would therefore be desirable to construct the generators for other woods also. Charcoal is burned in special generators fitted with dust purifiers. The wood gas is burned at very high compression. In Austria about fifty plants are in operation. L. S.

861. Wood Gas. H. Finkheimer. *Z. Ver. D. Ing.*, 1935, **79**, 205.—Practical trials with wood gas, using Bussing motors fitted with Imbert generators, showed a consumption of 0·8–0·84 kg. wood (beech with 12% moisture) per H.P. at full load. Purifier and generator construction is explained. L. S.

862. Traction Gas. *Mont. Rundschau Tankstation*, 1935 (4).—This is a report on the use of gas for commercial vehicles. Trials proved the following advantages: quick starting from cold, combustion free from odour, soot and smoke, no deposits on pistons and valves, low cleaning and maintenance costs, efficient mixing with combustion air and economical combustion, smooth anti-knock operation of the engine and even torque on the transmission, low oil consumption due to absence of dilution effects, and no vapour-locking in the fuel line. L. S.

863. Use of Solid Fuels in I.C. Engines. M. Moldenhauer. *Chem. Ztg.*, 1935, 356.—Reviewing the report by F. Schulte and W. Litterscheidt (*Deutsche Technik*, March,

1935) on the development of the coal-dust motor, the author indicates the difficulties due to the dust content of the combustion gases. On using a coal with 6% ash in a 1000-H.P. engine, 7½ kg. of dust per hour is obtained. Reduction of the ash content to about 0·06–0·1% is therefore necessary, but the procedure is costly; the use of carbon black is also too costly. Coal dust used for motors requires a pulverous or easily pulverized, practically ash-free combustible either of a natural origin or obtained as waste product from industrial processes. Both forms must be available in sufficient amount, and the material must develop enough heat energy. Combustibles of this kind are very rarely met with. The use of lignine seems to offer more possibilities; it is a light powder of low ash content, has a calorific value of 6000 cal., and is obtained on saccharification of wood. 100 Kg. dry conifer wood yield 30 kg. lignine and 24 litres alcohol. L. S.

864. Petroleum Coke as Household Fuel. O. F. Campbell. *Oil & Gas J.*, 28.3.35, **33** (45), 68.—The three normal methods of producing petroleum coke are: (1) Shell still coking, distilling a petroleum product to dryness by external heat. (2) Coking in chambers which are part of a cracking still, utilizing heat from the heating coil. (3) Knowles process, evaporating a petroleum product to dryness in an externally-fired refractory lined chamber. The coke from the Knowles process is usually very hard and dense, and contains less volatile matter than coke produced by the other two processes. Typical analyses are tabulated, and show that there is less variation in properties of petroleum coke from various sources and processes than there is in the properties of coals.

Petroleum coke is usually sold as lump, egg, screenings or still run (which includes the three other grades). Lump and egg are preferable for domestic purposes. Lump is an ideal fuel for fireplaces, radiating heat effectively and giving less ash than coal. The fire should be kindled in the same way as a coal fire, but more wood should be used, and no coke used until the wood is well alight. A few lumps should then be added and allowed to ignite before more is added. When used in coke furnaces it is important to see that the firing, ash-pit and draft doors fit tightly, or the fire may burn readily with all dampers and doors shut. It is important that all air should pass up through the grate and be controlled by the damper. Troubles due to clinkering may be encountered when (*a*) hot air-furnace fire-boxes are lined with refractory material, (*b*) using screenings, (*c*) garbage is disposed of in the furnace. It is necessary to have a clinker bed ¾ in. thick above the grates, consequently it is usual to start with coal so that the ash forms a satisfactory base for clinker formation. Alternatively broken brick in cubes of 2 in. may be used. The employment of a drilled steel plate placed in grates for protection is not recommended, owing to plugging of the holes, and is unnecessary, provided the correct clinker bed is found. When the depth of clinker becomes too great to permit the fire to respond to the damper, the bed may be broken up with ½ in. heavy round iron bar and one or two large clinkers removed. If the bed is too thin, some of the clinker previously removed should be replaced. All siftings falling through the grates should be returned to the furnace. The fuel-bed should be kept as thick as possible and at least 12 in. deep. Two particular advantages of petroleum coke over other solid fuels are: (1) less attention, owing to higher calorific value and consequent reduction in number of fillings, (2) improved sensitivity where thermostatic control is provided. R. A. E.

865. Meaning and Determination of Voids in Mineral Mixtures for Bituminous Cement. R. Soucek. *Asphalt u. Teer*, 1935, **13**, 267–269.—The article deals with the first principles of voids and gives formulæ to derive "degree of fineness" of powdered material and also "free space," or voids. The usual method of determining voids (which consists in displacing the air with water from a measured volume of the aggregate in a glass cylinder) is criticized on the score of giving inaccurate results. The surface tension of water prevents the stone being properly wetted, and the faster rate of rise of the water near the edges of the cylinder, and also flotation of the fine particles on the surface of the water, all tend to give low results. Furthermore, the glass cylinder is not perfectly rigid, and this fact gives rise to high results. The author claims better reproducibility and more accurate results using a brass cylinder.

Carbon tetrachloride is an improvement on water, but its volatility is a drawback, whereas aniline is free from this objection and gives results nearest to the calculated amount. J. L. T.

866. Coloured Bituminous Roof Paints. Anon. *Paint Manufacture*, 1935, **5**, 176.—Tar and asphaltic bitumens are unsuitable as base materials for coloured roofing felts and paints owing to their high pigment-absorptive capacity.

According to Dr. C. R. Platzmann (*Farbe u. Lack*, May 15th, 1935), natural asphalts, fatty pitches and albino asphalts are the best materials for this purpose.

An easy test for suitability consists in marking a porcelain or glass surface with the material, a pale brown mark indicating satisfactory pigment-absorptive power.

The brown asphalts mined in the U.S. and softening between 130° and 180° C. are in the author's opinion indispensable for this purpose. D. L. S.

867. Formation of Blisters on Asphalt Mastic Roofs. *J. Roy. Inst. Brit. Arch.*, 9.12.1933, **41**, 138.—The results of research work at the Building Research Station on the conditions favouring the formation of blisters on asphaltic mastic on concrete, are discussed. In a particular case, large blisters, up to 6 in. in diameter and height, appeared on a mastic roof after four years' exposure. On being opened up, beads of moisture were found suspended from the underside of the dome, the underlying area of concrete being dry, whereas in the plane areas the concrete and mastic were separated by a film of moisture. Possible explanations offered were: (1) evolution of gas from decomposition of unburnt coal in the breeze mixed with the concrete—no gas, however, was detected under the blister; (2) catalytic decomposition of the bitumen by chemical compounds in the aggregate.

An investigation of the conditions favouring blistering was carried out in order to determine the pressure required at different temperatures to cause blistering, and the behaviour of the mastic examined under conditions simulating natural exposure. It was found that in the case of moulds of bitumen on metal plates, little blistering occurred even at high temperatures and pressures, except where the bonding was poor or irregular, in which case large blisters were produced in a few hours at 35° C. with pressure equivalent to a head of only 2 ft. of water. Experiments were carried out with blocks of concrete coated on the sides and top with asphalt and placed in water to a depth of 3 in., the surface of the concrete being heated with lamps to 45° C. Lean concrete (1 : 3 : 6 mix.) produced small blisters after 150 hours' heating, and a denser mix. (1 : 2 : 4) larger blisters after 20 hours' heating. In the absence of water no blisters were produced. Exposure tests on the roof of the Building Research Station confirmed the laboratory tests. In all cases where blisters were readily formed, the bond between asphalt and concrete was poor.

It was concluded that the formation of blisters is due to pressure caused by the evaporation of moisture or by the compression of air or gas by the capillary pressure in the concrete. The blisters are more readily formed when the bond is poor, and with richer concrete mixes. Application of paper or sarking felt as underlay for the mastic should reduce blistering and prevention of absorption of water in parapets or by condensation should minimize trouble. C. L. G.

868. Spent Refinery Clays Employed in Plastic Waterproof Cements. A. R. Chandler. *Nat. Petr. News*, 10.4.35, **27** (15), 32.—The addition of 3% of spent refinery clay containing approximately 25% oil to Portland Cement has proved to have useful effects on the properties of the latter. The clay used should be from lubricating oil refinery processes, and is added to the clinker immediately before grinding. Marked improvement in impermeability to water, in plasticity, in " workability " and in actual strength are claimed, but the mechanism of the latter changes are not well understood. Cements containing spent clay harden more slowly, but ultimately are stronger than conventional material. H. G.

869. Paraffin-Impregnated Wood. J. Wientelak and J. Czarnecki. *Ind. Eng. Chem.*, 1935, **27**, 543.—The investigation concerns the possibility of impregnating the wood of the alder with paraffin in order to make it resistant to the effects of moisture. A two-stage procedure is employed: in the first, air and moisture is expelled from the interior of the cells by immersion in molten paraffin at 135° C., and in the second, the liquid paraffin is caused to fill the empty cavities by continued immersion (4–5 hours) in the paraffin bath at 71° C. Variations in the impregnation period have little effect on the amount of paraffin absorbed (93·2–97·8%), but impregnation in an autoclave shortens the time and lowers the temperature of impregnation. The treated wood when immersed in water or sulphuric acid absorbs the liquid and swells

and the sulphuric acid absorbed by the wood causes acetic acid formation, which increases with increase in acid strength. The paraffin impregnated wood has a surface hardness about three times that of the oven-dried wood. The hardness of the impregnated wood is unaffected by water or dilute acid (1–2%), but higher concentrations of acid affect the hardness considerably. W. H. T.

870. **Naphthenate Driers.** S. N. Greenfield. *Paint Manufacture*, 1935, **5**, 154–155.—Naphthenic acids are *cyclo*paraffin derivatives found in crude petroleum, and extracted during the ordinary course of refining.

Their salts possess high emulsifying properties and have been used as emulsifying agents.

When required as driers for oil paints the acids are purified by fractional distillation. It is claimed that the fraction distilling at 280–300° C. is to be preferred for the production of lead and manganese naphthenates, whilst that distilling at 270° C. is preferred for cobalt.

It is essential that these salts be water free, and a description is given of the preparation of a water-free lead cobalt naphthenate.

The advantages claimed for naphthenate driers are (*a*) the metallic salts do not oxidize during storage, (*b*) little or no skin formation, (*c*) consistent performance depending on metal content. D. L. S.

871. **Cutting Oils and Emulsions.** R. N. Smith. *Chem. Trade J.*, 19.4.35, **96** (2500), 297, from *Canadian Chem. & Met.*, March 1935.—Cutting oils or emulsions are chosen for the sake of their physical properties, viz. cooling, lubrication, smooth finish, washing away metal chips, protection of finished article from rust. Emulsions are also of value in prevention of dissipation of metallic dust into the atmosphere, *e.g.* in the working of cast iron. If rust or verdigris forms on the metal, the presence of acids, or possibly corrosive salts, is indicated. The fatty oil used may be rancid. If rusting occurs, it is usually due to the use of too weak an emulsion. Unsatisfactory emulsions may also result from the use of hard water. The " straight " oils (used without water) are mixtures of mineral oil with a fatty oil, such as lard or rape. The proportion of fatty oil is usually 5–25%, but for heavy work higher proportions may be used. The oils should not be too viscous, *e.g.* for low-speed operations 200–300 secs., and for high-speed operations 100–200 secs., R.I. at 100° F. are desirable limits. Sulphurized oils are of value in adding to the lubricating and cooling value of cutting oils, and give a remarkable finish with iron and steel. They are not suitable for brass and similar alloys, owing to the blackening action of the sulphur.

Soluble oils and pastes (used with water) usually contain one or more materials from the four groups: (1) mineral oil, (2) fats and fatty acids, (3) potash, soda, ammonia or borax, (4) water, alcohol. The bases unite with fatty acids and oils to produce soaps, to make an emulsion of the mineral oil and water. Soluble oils contain only small amounts of water, but the pastes 20–40% or even higher. Alcohol is sometimes used to give a clear, transparent, readily soluble oil. The speed and nature of the job and hardness of the metal determine the amount of water to be added to the oil or paste. A good product must contain enough soap to give a stable emulsion, enough fatty oil to give adequate lubrication and a relatively high proportion of mineral oil.

Complaints are generally concerned with rusting of metal or emulsion instability. The former is almost always due to the use of a weak emulsion, or separation of oil and water from an unstable emulsion. Separation may be due to poor quality of the oil or to development of acidity by accumulated filings, cuttings and dirt. Emulsions should be made with tepid water, thoroughly stirred until no lumps remain, filtered to remove solid matter and neutralized by adding soda. The water should be soft, hard waters being treated with soda before mixing. Skin infections can be prevented by cleanliness in handling the oil, and on the part of the workmen. Unclean habits on the part of the workmen and neglect of frequent and careful washing will nullify measures such as addition of antiseptics (*e.g.* carbolic acid) to the oil or sterilizing by heating the oil to 300° F. for a short period. Workmen with infected hands should be removed from service until free from infection. R. A. E.

872. **Regeneration of Waste Lubricating Oil.** J. H. Widmer. *Montan. Rundschau Tankst.*, 1935, (4), 6.—In England and America, mechanical methods for waste lubricating oil regeneration are preferred to chemical processes. For this purpose,

super-filters are used. Motor fuel is not removed, but dilution by fuel is innocuous because enrichment is not proportional to the operating time; after having reached a maximum, no further increase occurs. L. S.

873. Worm Gearing Lubrication Requirements. C. H. Schlesman. *J.S.A.E.*, 1935, **36**, 147–158.—In the work described, a typical production worm wheel is coupled through a splined shaft to a 200-H.P. cradle dynamometer. The differential is locked, and the drive transmitted through a single end at speeds ranging from 600 to 3600 r.p.m. The H.P. output and axle temperature are measured. Measurements of tooth wear (which is related to the position of the tooth on the wheel) and of bearing wear are also made. Graphs relating, *e.g.* H.P. absorbed and viscosity (churning losses), efficiency and H.P. input, and also temperature developed by the lubricant, are given, and photographs illustrate tooth wear and surface pitting. In the appendix are given details of the physical and chemical changes in the lubricant after 140 hours' service in the axle at a speed of 65 m.p.h., and also the characteristics of the lubricants investigated. A satisfactory lubricant must fulfil seven conditions. It must (1) minimize churning losses, (2) give high efficiency at normal loads, (3) carry high loads without seizure, (4) possess stability, (5) reduce the fatigue limit, (6) minimize wear of wheel worm and bearing, (7) have no adverse effect on the surface finish. No single lubricant satisfies all these requirements, and the lubricant must be chosen for each class of service. It is claimed that a well-refined mineral oil is best for general use where tooth loads are not excessive. The viscosity should be correct for the operating temperature, and the viscosity index should be tolerably good. The channeling point should be low. It is found that the A.S.T.M. pour-point determination is no guide to this, and the true test is to operate the axle in a cold room. Oxidation stability is best assessed by running the axle at a sustained load of 60 H.P. at 230° F. for the equivalent of 9200 miles.

For high loads a compounded oil plus some synthetic petroleum fatty acids is recommended. Fatty oils tend to form rubber-like polymerization products at high temperatures, whilst free fatty acids accentuate corrosion troubles. Very active extreme-pressure lubricants produce rapid wheel wear by corrosion, and failure of the lubricant as a result of excessive oxidation. Finally, greases prevent leakage, but cause bronze chippings to float into the anti-friction bearings; the presence of water causes the precipitation of soap in some types of greases, and emulsification in others, with resulting rise in consistency. J. L. T.

874. World Production and Consumption of Paraffin Wax. Anon. *Chem. Trade J.*, 3.5.35, **96** (2502).—"Die Chemische Industrie" estimate world production in 1933 to have been 400,000 tons, of which 87% was produced from mineral oil, 8% from oil shale, 5% from lignite tar. The U.S.A. was responsible for 52%, British India 13%, D.E.I. 10%. World consumption was 419,000 tons in 1933 and 368,000 tons in 1932. The candle industry consumed 62% and the match industry 5% of this total. The balance was consumed for impregnation of paper, finishing textiles, electrical insulation, admixture with other waxes, conservation of food-stuffs, chewing gum, medicinal purposes, polishing creams, etc. Consumption in the U.K. was 62,500 tons, of which 50·8% was used by the candle industry. Domestic production covers from 20 to 25% of the amount used in the U.K. R. A. E.

875. Insecticides and Fungicides. R. C. Roark. *Ind. Eng. Chem.*, 1935, **27**, 530.—The economic importance and consumption of insecticides and fungicides are reviewed. The disadvantages of inorganic materials such as lead, arsenic compounds, etc., are stressed and the superiority of organic materials is pointed out, for these materials are more toxic to insects and less toxic to mammals than are the inorganic insecticides and fungicides. Such materials may be extracted from plants or synthesized from compounds derived from natural gas, petroleum and shale oil, coal, etc. Pharmacological testing of new products should accompany their insecticidal testing, in order that materials poisonous to man and domestic animals can be avoided. W. H. T.

BOOK REVIEWS AND BOOKS RECEIVED.

Reviews.

THE PRINCIPLES OF MOTOR FUEL PREPARATION AND APPLICATION. Vol. II. Alfred W. Nash and Donald A. Howes. Pp. xiv + 523. 1935. Chapman and Hall. London. 30*s*.

The second volume of the "Principles of Motor Fuel Preparation and Application" deals generally with the properties of motor fuel, and chapters are given in which the question of sulphur and gum contents of motor fuel are discussed from every aspect. The theory and practice of the utilization of both motor spirit and diesel fuels are discussed in separate chapters.

A full discussion is also given of the effect of fuel volatility characteristics on engine performance, and knock-rating, and also a separate chapter is included on Aviation Fuels.

The two volumes together provide a complete survey of fuels for internal-combustion engines, and each chapter gives a complete account of all the important work on the subject. Thus, the chapter on knock-rating describes not only the development of knock testing, but also the current theories of detonation and the knock-ratings of the individual types of pure hydrocarbons present in gasolines. This chapter also includes a full description of the use of tetraethyl lead in motor fuels and a description of the present standard methods for the rating of fuels.

The chapter on motor fuel specifications and properties marketed in different countries gives a *résumé* of the development of specifications since 1915, and therefore some indication of the future trend; however, even since the preparation of the book changes have taken place in the spirit marketed in the United States, Great Britain and France, and even in other countries, the tests quoted—more particularly in so far as octane number is concerned—have changed since the matter incorporated in this chapter was prepared.

One comment which should be made is that in some few instances references to the Institution of Petroleum Technologists methods of test are included which are now out of date owing to the recent issue of the new I.P.T. Standard Methods for Testing.

A series of tables is included at the end of the book, which have been very carefully selected, and include, in addition to the usual physical data on motor fuels, figures for latent heat, viscosity, specific heat, formulæ for horse-power, torque, and mean effective pressure, and statistical data.

"The Principles of Motor Fuel Preparation and Application" is the most complete and authoritative textbook published up to the present time dealing with the question of gasolines and motor fuels generally, and fuels for high-speed diesel engines.

F. H. GARNER.

LIQUID FUELS, THEIR MANUFACTURE, PROPERTIES, UTILIZATION AND ANALYSIS. H. Moore. Pp. 263. 1935. The Technical Press, Ltd. London. 21*s*.

So many books have been published bearing a similar title to that borne by the subject of this review that a further addition to the list would seem scarcely warranted unless it possessed some unusual features in its scope and method of treating the subject.

In the author's preface, reference is made to a previous work of his, published in 1917, dealing with "Liquid Fuels for Internal Combustion Engines," and it is explained that the present volume is not a rewritten edition of the former work, but an entirely new book enlarged in scope so as to include fuels for external combustion.

The inclusion of these two aspects of liquid fuel utilization in one volume provides sufficient warranty for its appearance so soon after the publication of the comprehensive work by Nash and Howes, which deals chiefly with the former aspect.

The work is divided into six parts, the first two dealing with the chemistry and preparation of liquid fuels, the third on the relation between their chemical and physical properties and engine efficiency.

Part IV contains notes on fuels for internal-combustion engines, and is subdivided

into two chapters, the first dealing with fuels for engines fitted with carburettors and vaporizers, the second referring to engines with atomizers.

The fifth part is contributed by Mr. C. I. Kelly, and includes a chapter on the chemistry of combustion, and two chapters on the use of liquid fuel for external combustion.

The final part, written in collaboration with Mr. W. A. Woodrow, described the chief methods of analysis and the valuation of liquid fuels.

The sub-title of the book leads the reader to anticipate and hope for some specialized information relating to the manufacture of liquid fuels—something additional, in fact, to that obtainable from the large number of modern textbooks dealing with methods of refining.

In this respect Part II is distinctly disappointing. The section headed "Preparation of Liquid Fuels" contains, in the section relating to petroleum fuel, some 34 pages into which are squeezed, with some amount of unnecessary detail, such diverse matters as theories of origin, methods of drilling, tables of statistics for world production, the theory of distillation, the history of cracking processes, the refining and dewaxing of lubricating oils and a number of other items of general information which have only an indirect connection with the preparation of liquid fuels.

In the very early days of liquid fuel utilization, the reading, and tentatively consuming, public knew very little about petroleum fuel, and writers on the subject had some legitimate excuse for prefacing their works with a survey of the general subject. In a preface to his now classic work on Liquid Fuel, published in 1903, W. H. Booth alludes to the popular idea of the commodity as being "very hazy," and his opening chapter touches lightly upon such subjects as petroleum geology and methods of drilling, but this educative preamble occupied scarcely six pages of reading matter before the main subject was commenced. It is the opinion of the writer that the present work under review would gain considerably by a substantial curtailment of what may be termed extraneous matter.

Shale oil, coal tar, lignite tars, the products of wood and peat carbonization, animal and vegetable oils, occupy the next 21 pages, and to these the above criticism cannot be applied, or at any rate not to the same degree, for the information therein is well set out and arranged, besides being of interest and value to a reader desirous of obtaining authentic data regarding these minor sources of liquid fuel.

The succeeding chapter on ethyl alcohol is also a useful contribution, and summarizes some valuable information.

Quite the most valuable portion of the book is contained in the two parts dealing with the relation between engine efficiency and the chemical and physical properties of fuel, and the notes on fuels for engines, these subjects occupying about 64 pages of the text.

In these pages the author has been able to include a great deal of information culled from his own experiments and experience which considerably enhances their value. Of particular interest in this connection are his remarks relating to the comparative value of the Research and Motor methods of determining anti-knock properties.

Mr. Kelly's contribution to the work in Part V is a very valuable and thoroughly up-to-date summary of available information relating to the utilization of liquid fuels for external combustion. The part relating to the use of bottled gas will be of special interest to readers in this country, where this commodity is little known.

The final part, dealing with the analytical methods usually applied to liquid fuels, calls for little comment, since the majority of these are standardized and well known.

We should be inclined to challenge the statement that the "weight of 1 gallon of oil is ten times its specific gravity," the latter term having been previously defined and subsequently referred to as being on a 60/60° F. basis. In strict accuracy the statement holds good only when the specific gravity is on the basis 62/62° F.

Viewed as a whole, the work can be considered as sufficiently unlike the generality of the many books on the same subject, already published, as to deserve a place in the library of all technologists. It is well printed and illustrated, on good paper, and the text is remarkably easy to read. Only a few misprints were noticed during a first reading. Dr. Lang's name in the footnote on page 225 has been misspelt. The spelling of kerosine is not in accordance with present practice, and such expressions as "Master Lubricant" and "Capacity Still" are somewhat unusual.

J. McConnell Sanders.

LE CHAUFFAGE PAR LES COMBUSTIBLES LIQUIDES. A. Guillermic. Pp. 394. 1935. Librairie Polytechnique Ch. Béranger. Paris & Liége. *Fr.* 110.

To those who open this book with a preformed idea that it deals with a somewhat well-worn subject, its contents will furnish a pleasant surprise.

A preface written by Mr. F. Gilabert, director of the Société Générale des Huiles de Pétrole, refers to the work as "filling a veritable hiatus," with the further remark that no other work of its kind is in existence. Although these phrases may seem to err on the side of extravagance when applied to countries outside its place of origin, there is no doubt that English readers will find much that is novel and of great practical value in this very able compilation.

The industrial utilization of fuel oil on anything like a large scale is of comparatively recent date in France. The shortage of coal during the Great War was responsible for directing public attention towards its liquid substitute, chiefly for use in metallurgical furnaces. After the Armistice its application for marine bunkers became general, but not until 1925 were there any central heating installations in use. Towards the end of 1934 the latter type of appliance had risen to about 12,000 in number, and according to the author the general utilization of liquid fuel for heating purposes is growing rapidly more important.

Central heating is dealt with very thoroughly in the present volume, but the latter's scope is not confined to that aspect of the subject as will be seen from the following survey of its contents.

The book commences with a commendably short chapter of 10 pages dealing with essential definitions and generalities. Priority of place is given to fuel derived from petroleum, for which in France the Russian term Mazout has been generally adopted. Three types of fuel are referred to as gas oil, diesel oil, and fuel oil, the latter being classified as either light or heavy. In France gas oil is coloured red when destined for use in stationary engines, and is subject to a lower tax than when used for road vehicles, when it is coloured blue.

Reference is made to a law promulgated in 1934, whereby gas oil became so highly taxed that its use for external combustion purposes became prohibitive. The oil companies have therefore introduced a further class of product known as domestic fuel oil, which is not subject to the tax.

The second chapter is devoted to primary and secondary storage of liquid fuel, and includes extracts from official regulations governing the installation of tanks and underground reservoirs for fuels having flash-points above 80° C. Considerable space is given in these regulations to methods for properly earthing the tanks and determining the electrical resistance of the earthing circuit.

Chapter III embodies a short summary of the elements comprising an installation, classified according to the type of fuel and the heating surface to be dealt with.

The next five chapters deal exhaustively with the various types of burner, classified, described and illustrated according to the methods whereby vaporization or atomization is secured. Many of the burners described will be new to English readers, although they are said to be representative of appliances actually available on the French market.

Chapter IX, a long one of 72 pages, is a valuable and interesting part of the work. It deals with appliances for regulating, automatically or otherwise, the various units of an installation, and the many devices which have been invented for preventing a breakdown or diminishing any serious consequences as a result of such a contingency.

Of particular interest in this connection is the description of apparatus which makes use of the photo-electric cell, and of cells which are sensitive to infra-red radiation.

Since the author is an electrical engineer it is but natural that considerable space should be devoted to electrical methods of control, and this part of the work is exceptionally well done and illustrated.

The subject-matter of Chapter X is one which is frequently neglected or "dismissed with a caution" in works of this kind. It deals with the many accessory appliances which form a necessary and important part of every fuel oil installation. Pumps, air compressors, fans, filters and fuel oil heaters are here dealt with in considerable practical detail, the last mentioned being the subject of an elaborate mathematical exposition of the theories which underlie the generation, yield and economical utilization of heat for warming up the fuel so as to ensure constant and uniform supply to the burners under conditions of automatic control.

The concluding chapters comprise a very comprehensive survey of the application of liquid fuel for all kinds of industrial heating. Chapter XI discusses the theory of flame production and the effect of atomization conditions, air supply, chimney draught, and furnace design on the shape, size and temperature of the flame.

Following this comes a long series of what are termed "Examples of Equipment," which include numerous arrangements of burner, furnace brickwork and air supply so as to illustrate the practical application of the theories previously expounded. Such diverse applications as central heating establishments, steam-raising plant, hot-air producers, forges, smelters, enamelling and galvanizing furnaces, cement kilns, bakers ovens, incinerators, destructors, cooking stoves and crematorium ovens are described and illustrated with considerable detail, and the reader is supplied with much relevant information regarding the temperatures obtainable and the consumption of fuel.

The final chapter describes a number of types of automatic central heating installations showing how the failure of any part of the system is taken care of, and how the various elements can be arranged for remote control by thermostat or similar device, according to predetermined limits for temperature or humidity.

This is followed by a very complete exposition of methods for calculating the running costs of the various heating systems, illustrated by numerous graphs for facilitating the computations, and further illustrated by a series of examples from actual practice comparing the relative costs of oil and coal.

The author concludes with some general observations of a practical significance. He points out that among the very large number of liquid fuel installations actually in use the majority are giving excellent results, nevertheless in some cases the results have been inconclusive and in a few frankly negative.

He is of the opinion that almost all the cases of non-success would have been avoided if, before attempting to utilize fuel oil, it had been assured that the installation functioned correctly with coal, that the appliance was suitably designed for oil heating and that the draught and working conditions were suitable for the particular fuel it was proposed to employ—in fact, he points out, it would be better in many cases to refrain from attempting to substitute oil for coal unless all the conditions for suitably utilizing the former could be adequately realized.

To conclude, it may be stated that this work is quite one of the best that has been published in recent years on the subject of heating by liquid fuel. During its perusal the reader is conscious of the author's practical grasp of his subject, and of the fact that a considerable amount of personal experience lies behind his remarks. There is a commendable absence of "padding" or unnecessary descriptive verbiage—in fact, many of the subjects dealt with would bear a little extension with advantage.

A few small errors may be mentioned, which can be remedied in a subsequent edition. On page 3, for instance, it is stated that the density of fuel oils is expressed in England in Twaddell degrees, whilst on page 4 the formula connecting gravity and calorific value should be ascribed to Shermann and Kropff, and written $P = 18{,}650 + 40(a - 10)$.

J. McCONNELL SANDERS.

THE MUD VOLCANOES OF BECIU–BERCA (RUMANIA). K. Krejci-Graf. "Geol. Charakterbilder," No. 40, ed. Dr. K. Andrée. Pp. 24 and 8 plates. 1935. Verlag. G. Borntraeger. Berlin. 11.50 Rm.

In the series of "Geologische Charakterbilder," in which the above paper appears, reproductions of photographs are published which give a typical picture of characteristic geological or geographical features, each issue dealing with a special problem or a special geographical area. The pictures are accompanied by an explanatory discussion. The title of each picture is given both in German and in English; it would be still more helpful if an English summary of the explanatory notes were added.

It is the purpose of the "Geologische Charakterbilder" to provide all those who are engaged in geological and geographical studies (professors and students, museums, etc.) with reliable and carefully selected material for instruction and demonstration.

Krejci's publication, No. 40 of the series, answers these requirements very well, and one of the most interesting and instructive features of his paper is the series of ten excellent photographs which clearly depict the forms and the various stages in the development of these famous Rumanian mud volcanoes.

Although a comprehensive monograph with a broad discussion of the local geology, etc., is not to be expected, Krejci's account is very concentrated, and the whole problem

is not only considered from a descriptive point of view, but the origin and development of the mud volcanoes are discussed too. For this reason the paper is also of a more general interest. The reader would undoubtedly appreciate having at hand, besides the sketch-map showing the tectonical situation of the mud volcanoes, also a rough small-scale sketch-map on which the general geographical location is indicated.

Dr. H. Kugler's "Contribution to the Knowledge of Sedimentary Volcanism in Trinidad" (*J.I.P.T.*, 1933, **19**, 743–760), has recently directed attention to a chapter of geology which has often been neglected, but which, particularly for the oil geologist, is of outstanding interest. Krejci's paper is a further, most valuable contribution in this direction.

The author writes from his ample local experience, and the reviewer has little to add. In the following, therefore, the contents of Krejci's paper may be shortly summarized:

Some definitions are first given regarding solid, plastic, fluid and gaseous material and its behaviour under pressure. The mud volcanoes under consideration occur in three different groups, all situated on the Arbanasi-anticline, a N.N.E.–S.S.W. running front-fold of the Carpathian Mts. in the area where they bend from a N.–S. to a westerly direction.

According to Krejci, this anticline is at the surface composed of Pliocene formations. The bottom part of the Pliocene (Meotic) represents the main producing oil formation of Rumania. The axis of the anticline shows a northern (Beciu) and a southern (Berca) culmination and a disturbed cross-depression to which the two northern mud-volcano fields seem to be related. The mud volcanoes are situated on old terraces, and not in the bottom of the valleys.

The volcanoes produce gas, water with oil traces, mud and some stones. The water is apparently partly vadose, and its quantity and salt content depend to a certain degree on atmospheric conditions.

The form of the mud volcanoes depends on the thickness or plasticity of the mud, which varies from nearly pure water to a thick and tough paste, and on the intensity of the flow: if only a little mud is produced, it dries out quickly and the slopes of the volcanoes become steep.

The pipe, without any accumulation of material around it, might represent a very young stage. This is followed by the pipe from which a small stream of mud is beginning to flow, a stage which is commonly observed. If the channel is washed out and widened, more material is produced. The quantity of mud also depends on the gas pressure of the source formation. If tough, viscous material is slowly pressed out, very steep cones are the result; if the mud is thinner, flatter cones are built up. Thin material flowing in considerable quantity forms a flat shield. As the material produced dries out on the outer border, a central mud lake surrounded by a dry wall is often observed. If the mud volcano in its further development happens to dry out (often in connection with long periods of dry weather), the mouth of the mud volcano becomes encircled by a concentric system of faults. The final stage is, therefore, very often a faulted circular basin.

The three mud volcano fields represent three different states of development:

1. Paclelele mici: intensive activity, mud often thick and tough, steep and flat cones, no faulted mud basin.
2. Paclelele mari: less intensive activity, mud thinner, flat cones and shields, faulted mud basins.
3. Berca: cones eroded, faulted basins common with reduced activity.

The different types of volcanoes are, however, not sharply separated, and young and older volcanoes may be close together. The hydrostatic level in neighbouring volcanoes generally seems to be independent. The pressure is not due to tectonical pressure, but to the gas pressure, which is partly explained as "fossil" tectonical pressure. The form and the activity of the mud volcanoes show many close relations to real volcanoes.

To the above summary we would add only a few remarks:

Krejci's statement that the Meotic is the deepest outcropping formation is not quite correct—at least, not for the mud-volcano group of Berca. In this southern culmination the anticline proved to be pierced by a core of Lower Salt formation (Lower

Miocene and/or Upper Oligocene), which is generally considered to represent the source-formation of the Meotic oil. The mud volcanoes of Berca are strictly dependent on this outcropping argillaceous core, which towards the west is separated from the Meotic by a narrow zone of Sarmatic. To the east a (thrust-)fault brings the Salt formation against the Pontic (overlying the Meotic), the Sarmatic and Meotic being entirely squeezed out.

Krejci makes no clear statement regarding the gas-source of the mud-volcanoes, but one gets the impression that he derives the gases mainly from the Meotic oil sands. On the other hand, he admits, for the Berca group, that the boulders of Sarmatic limestone should have been ejected by the mud volcanoes, *i.e.* that the mud flow coming from a greater depth should have passed through the Sarmatic.

Furthermore, it might be questioned whether the mud volcanoes are really situated on Quaternary Terraces (also assumed by former authors). The occurrence of abundant angular (!) blocks of material which is older than Meotic has been explained by this assumption. In accordance with the above observation, the reviewer has the impression that these terraces are, perhaps not entirely, but for the greater part, built up of large-sized mud-flows at an earlier more active stage. The present volcanoes would thus represent late and very modest descendants of these former mud volcanoes, which would have brought up the angular blocks of older material from a greater depth.

It was not the author's intention to discuss the genetic problems exhaustively, and the reviewer would therefore make the above remark not as an undue criticism, but would only point out some problems which are not yet quite clear.

P. KELTERBORN.

Books Received.

AMERICAN PETROLEUM INSTITUTE:

A.P.I. SPECIFICATIONS FOR OIL WELL PUMPS. Supplement No. 4.
A.P.I. SUCKER ROD SPECIFICATIONS. Supplement No. 1.
A.P.I. SPECIFICATIONS FOR OIL FIELD BOILERS (LOCOMOTIVE TYPE). Supplement No. 1.

The above supplements to A.P.I. Specifications were approved at the Mid-Year Meeting in May 1934.

AMERICAN SOCIETY FOR TESTING MATERIALS: CONCRETE AND CONCRETE AGGREGATES, REPORT OF SIGNIFICANCE OF TESTS. Pp. 123. 1935. American Society for Testing Materials, 260 S. Broad Street, Philadelphia, Pa. $1.25.

This is the Report of Committee C-9 on Concrete Aggregates of the A.S.T.M. Following an introduction by Prof. A. N. Talbot, ten sections are devoted to concrete tests and six to aggregates. The tests for concrete discussed are those referring to compressive, tensile and shearing strength, durability, abrasion, workability, cement content and uniformity. The tests for aggregates refer to sieve analysis, soundness, abrasion, the occurrence of deleterious substances, the determination of absorption, and the mortar strength of fine aggregates. The aim throughout is to indicate the scope and limitations of various tests, and to provide a commentary on their interpretation for the guidance of civil engineers in writing specifications.

A discussion of the number of specimens or tests required for reasonable accuracy of the average completes the Report.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH:

HYDROGENATION-CRACKING OF TARS. PART I. PRELIMINARY EXPERIMENTS. Pp. 107. 1935. H.M. Stat. Office, London. 2*s.* net.
HYDROGENATION-CRACKING OF TARS. PART II. THE PREPARATION OF A CATALYST. Pp. 17. 1935. H.M. Stat. Office, London. 6*d.* net.

The first of these papers deals with the early exploratory work in connection with the production of fuel oil and motor spirit from tars. The details of the experimental

work and the results of engine tests on the products are given, together with the results of preliminary work on the production of lubricating oil from the heavier fractions.

The second paper discusses the selection of a suitable catalyst for hydrogenation-cracking, together with results of experiments on the pre-treatment and reactivation of the catalyst.

DIESEL ENGINE USERS ASSOCIATION. REPORT ON HEAVY-OIL ENGINE WORKING COSTS (1933–1934). Pp. 32. 1935. D.E.U.A., London. 10*s.* 6*d.*

The report of the Committee on Heavy-Oil Engine Working Costs for 1933–1934 was presented for discussion on Jan. 23rd, 1935. The number of stations from which results were submitted was 57, *i.e.* 3 more than in the previous year, the total number of units generated being 147,876,312 compared with 138,262,787 in 1932–1933. The number of engines reported on is 275, the total capacity being 88,096 kw. The average fuel oil consumption per unit generated was 0·642 lb. in 1933–1934, and 0·648 lb. in 1932–1933, while the average number of rated b.h.p. hours run per gallon of lubricating oil was 1900 for home stations and 2380 for overseas stations.

INSTITUTE OF MARINE ENGINEERS. TRANSACTIONS, Vol. 46, 1934–1935. Pp. xlii + 333.

This volume covers the papers read before the Institute during 1934, together with contributed papers, and includes the following: "The Origin and Development of the Heavy Oil Engine," by S. Hicks; "Some Observations on Fuel for Heavy Oil Engines," by L. J. Le Mesurier and R. Stansfield; "Some Diesel Engine Lubrication Difficulties and their Remedies," by A. Wolf; "Lubricants for Marine Steam Prime Movers," by A. Wolf; "An Oil Fuel Burner of Variable Output, with Notes on the Theory and Principles Involved, and Some Results," by S. O. Grant; "Wear of Piston Rings and Liners Influenced by Design of Rings," by W. G. G. Gordon.

INSTITUTO SUPERIORE DI SCIENZE ECONOMICHE E COMMERCIALI CATANIA. ANNALI DI MERCEOLOGIA SICILIANA. Vol. II, 1933–1934. Pp. 319. 1934. Officina Grafica Moderna, Catania.

L'AUTORAIL. Pp. 148. 1935. La Revue Pétrolifère, Paris. Fr. 50.

This special number of La Revue Pétrolifère deals entirely with the application of the diesel engine to railroad purposes. After a short historical note, various technical problems are discussed, including lubrication, transmission, construction, streamlining and braking. Considerable space is given to the types of rail cars produced by various manufacturers on the Continent, in England and in the United States.

The book is furnished with excellent illustrations and should be a source of valuable data to those interested in the subject.

SKINNER, W. E. OIL AND PETROLEUM YEAR BOOK, 1935. Pp. lviii + 352. 1935. W. E. Skinner, London. 7*s.* 6*d.* (Post free, 8*s.* 6*d.*)

The twenty-sixth edition of this well-known year book follows the lines of its predecessors, giving information regarding petroleum companies and their activities. A useful directory of directors, engineers and secretaries is included, together with a list of trade names of petroleum products.

U.S. GEOLOGICAL SURVEY:

BULLETIN 851. THE BOOK CLIFFS COAL FIELD IN GARFIELD AND MESA COUNTIES, COLORADO. Charles E. Erdman. Pp. vi + 150. 1934. Supt. of Documents, Washington, D.C. 35 cents.

The Colorado portion of the Book Cliffs coal field has an area of about 500 square miles. Part of the area has been tested for the occurrence of oil and gas, and in several wells indications of gas have been met with.

U.S. GEOLOGICAL SURVEY:

PROFESSIONAL PAPER 185-B. PALEOZOIC FORMATIONS OF THE MOSQUITA RANGE, COLORADO. J. Harlan Johnson. Pp. 29. 1934. Supt. of Documents, Washington, D.C. 10 cents.

PROFESSIONAL PAPER 185-C. THE RECOGNIZABLE SPECIES OF THE GREEN RIVER FLORA. Roland W. Brown. Pp. 32. 1934. Supt. of Documents, Washington, D.C. 10 cents.

PROFESSIONAL PAPER 185-E. MIOCENE PLANTS FROM IDAHO. Edward Wilber Berry. Pp. 27. 1934. Supt. of Documents, Washington, D.C. 10 cents.

ABSTRACTS.

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Class 100. Geographic Occurrence.

876. Petroleum Literature 1934. W. S. E. Clarke. *J.I.P.T.*, 1935, **21**, 546–568.—A complete and classified review of petroleum literature of 1934. G. R. N.

877. Statistics. G. Sell. *J.I.P.T.*, 1935, **21**, 569–578.—A concise tabulated review of the world production and consumption of petroleum and its products during 1934. G. R. N.

878. Three Hundred Years of Oil. G. Egloff. *Ind. Eng. Chem.*, 1935, **27**, 648.—A historical review of the development of the American petroleum industry and of recent developments in the use of anti-oxidants, cracked gas, in solvent refining of lubricating oils and hydrogenation. W. H. T.

879. Petroleum Territories of New Zealand. A. B. Douglas. *Mon. Petr. Roum.*, 1935, **36**, 769–773.—The article describes very fully the history of the search for oil in New Zealand and the varying degrees of success which have attended the various efforts. These efforts started in 1865 and have continued ever since; in fact, sales of crude oil in recent years have realized about £3000 per annum. The most fruitful district is near New Plymouth, where three producing wells are in existence. The crude obtained is of greenish colour, free from water, and gives approximately 20% gasoline, 40% kerosine, 37% lubricating oil and wax and 3% residue. The wells are mainly 2000 ft. or over in depth, and No. 2 well, Taranaki, is producing 400 gallons a day, and up to September 8th, 1934, had produced 559,619 gallons. The Government of New Zealand is conducting geophysical exploration with a view to obtaining more information regarding the future possibilities of these regions. The paper also furnishes figures giving the consumption of motor spirit in the Dominion for the years 1928–1932 inclusive; about 200,000 tonnes a year are consumed, imported as finished product. W. E. J. B.

Class 200. Geology and Origin.

880. Geology of Petroleum. V. C. Illing. *J.I.P.T.*, 1935, **21**, 491–495.—A review of the literature published during 1934 on the geology of petroleum. G. R. N.

881. Geology of the Oilfields. S. E. Comber. *J.I.P.T.*, 1935, **21**, 496–503.—A review of the literature published during 1934 on oilfield geology. G. R. N.

882. Belle Isle Salt Dome, St. Mary Parish, Louisiana. D. C. Barton. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 645–650.—Belle Isle salt dome, which is 15 miles S.S.W. of Morgan City, is a very shallow subsidiary spine type of dome. Much of the upper part lies at a depth of 300–500 ft. and is covered by cap-rock. At the north end of the dome a spine of salt rises to within almost 100 ft. of the surface. Subsidiary spines are present which the author considers are the result of localized uplift.

A detailed geophysical survey has been made, and from 1926, since the publication of Vaughan's paper on the "Geology of Salt Dome Oilfields," a series of wells has been drilled. This paper is therefore intended to supplement Vaughan's account with the newest knowledge obtained from this survey.

A sub-circular dome is now proved of 6000–8000 ft. in diameter; the centre of the dome lies in the N.W. part of South Pond and a thick cap occurs at a depth of 350–700 ft. over the south half of the structure.

Summarized well data, a map, and a cross-section across the dome accompany the paper. G. S. S.

883. Post-Fleming Surface Formations of Coastal South-east Texas and South Louisiana. J. Doering. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 651–688.—The Post-Fleming area extends about 500 miles along the Gulf Coast from the Colorado River in Texas to the Pearl River at the eastern boundary of Louisiana. It is subdivided into four units—Recent, Beaumont, Lissie and Willis. "Fleming" is used as the general name for the clay beds overlying the Catahoula and underlying the formations dealt with by the author.

Willis is the name proposed for the sands occurring at or near the base of the post-Fleming group. It is roughly equivalent to the old Lafayette and Reynosa of this area, and is subdivided into three members with a maximum thickness of 125 ft.; these are described in detail.

The *Lissie* consists of sands and sandy clays. A discordance in rate of dip gives the formation a coastward thickening of about 15 ft. per mile; from this an estimated thickness of 1000 ft. at the present coast-line is derived.

The *Beaumont* is the most extensive of the post-Fleming formations, covering about half of the total area occupied by the group. Along the coast it is said to have a minimum thickness of 100 ft. It is mainly composed of clays and sandy clays.

The general structure of the area is shown in a series of detailed maps and sections. Continuous dips of the formations towards the coast are interpreted as due to tilting movements which occurred between the several cycles of deposition. Small noses and bulges interrupt at intervals the regularity of the structural contours, and these are considered as indications of underlying subsurface structures. In the Willis areas the disturbances, in some cases, show an uplift of 50 ft.

Conclusions are also reached as to the origin and history of the formations, and methods of mapping are discussed. G. S. S.

884. Variation and Migration of Crude Oil at Spindletop, Jefferson County, Texas. D. C. Barton. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 618–643.—Analyses of the Spindletop crude oils show that four different types are present, one of which, Type B, is divisible into two sub-types. Each of them has a common individuality, which in certain characters is distinctive from that of the other groups.

An increase of the A.P.I. gravity of the oil with increasing depth is shown; *e.g.* in Type A (cap-rock), the gravity of the lighter fractions is the least of all the crudes and the greatest for the fractions heavier than 250–275° C. atmospheric pressure. In Type B the A.P.I. gravity of the fractions from 0 to 200° C. 40 mm. through residuum is distinctly lower than that of the corresponding fractions of Type A, and that of the fractions 175–200° C. distinctly lower than that of the corresponding fractions of Types C and D. Tables are furnished giving the viscosity fractions, with other data, of all types.

In occurrence, Types B, C and D are indigenous to the Middle Miocene, Lower Miocene and Oligocene, respectively; whilst Type A (the cap-rock crude) must be migrant, for the origin of the cap-rock precludes an indigenous derivation of the crude.

It is thought that the use of the A.P.I. gravity interval between the successive 25° C. distillation fractions, in conjunction with the A.P.I. gravity of those fractions, may prove to be an important method for the identification of crudes from different source beds. At Spindletop the application and results of this technique appear to be quite successful.

Migration upward from some deep source-beds is a common explanation of the source of any particular crude. Spindletop, however, furnishes a case of a field in which no upper type has been derived by upward migration without essential change of character from any of the lower types. Slight migration of crude in two of the groups was noted, but the distinct individuality of each type proves that it is not essentially unchanged migrant crude of any of the others, for the molecular composition is entirely different in each case.

Not one of them can have been formed by any simple alteration from any other of the three types. Any alteration which would produce one from another must involve a complicated and drastic change in the fundamental molecular character of the crude.

The author concludes: that the explanation of the differences between such varied types of crude by the alteration of migrant crude of one type to form another, is at present much more improbable than that of derivation of the crudes respectively from different source-beds. G. S. S.

885. Characterization of Lower Chalk Strata by Means of Microfauna. W. Eichenberg. *Oel and Kohle*, 1935, **11**, 388–412.—A detailed classification of fossils obtainable from different levels by core sampling in the region of the North German oilfields. The vertical distribution of 202 typical microfauna is shown photographically and by means of tables. This classification is stated to be of considerable value as a guide in drilling for oil. P. G. H.

886. Metamorphism of Organic Sediments and Derived Oils. D. White. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 589–617.—The author discusses the criticisms and queries that have been raised since the publication of his paper of 20 years ago on "Some Relations in Origin between Coal and Petroleum."

He gives primary attention to the progressive regional metamorphism of the mother rocks of coal and oil. The metamorphism of organic sediments, whilst apparent at early stages, progresses with all its features (dehydration, cleavage, chemical change, etc.) in exactly the same manner as the progressive metamorphism of inorganic sediments.

The author holds that the periods of advancement are those of most active oil generation and of metamorphism represented by cracking, followed by probable underground enrichment of oil in confinement. The oil "dead line" or extinction zone—where the oils are no longer liquid at surface temperature and atmospheric pressure—is shown in many cases to fall in a zone narrower than at first defined. It is probable that little commercial oil will, in general, have been found where the reliability determined carbonization exceeds 62.

The generation of oil is believed to have occurred in several cycles, and in all cases under dynamic influences. This is borne out by the fact that oils may be produced directly from the mother-substance within several temperature zones by distillation, or from other oils by distillation, by cracking, or by hydrogenation.

Relations of regional metamorphism to the "Law of Hilt" are discussed, together with sources of error in defining the extinction zone. G. S. S.

887. Geophysics. H. Shaw. *J.I.P.T.*, 1935, **21**, 504–511.—The various geophysical methods of prospecting and the instruments used and invented during 1934 are described. G. R. N.

Class 300. Development and Production.

888. Drilling. M. C. Seamark. *J.I.P.T.*, 1935, **21**, 512–515.—A short account of work published during 1934 dealing with drilling. G. R. N.

889. Progress and Trends in Drilling Practice. K. C. Sclater. *Petr. Eng.* Midyear, 1935, **6**, (9), 19.—Drilling has increased in volume and drilling costs have been given close attention. Equipment of the heaviest type is being unitized in order to increase its portability and so save time in setting-up.

One well in Upton County, Texas, is approaching 13,000 ft., and another in the Eelridge field, California, has been successfully completed at 11,377 ft.

A double-deck design travelling block has been under test, but no details are yet available, and a new type of rotary feed control has been successfully used.

Attention has been paid to the generation of steam in order to effect economies, and superheaters are being more widely used.

Drilling fluids have received attention, and the use of fibrous sealing materials has been experimented with.

Desanding equipment for drilling muds are coming into wide use in deep drilling operations. Further applications of controlled directional drilling have been developed.

Improvements have been made in the design of casinghead equipment.

L. V. W. C.

890. Central Plant Profitably Provides Water Supply at Kettleman Hills. J. C. Albright. *Oil Weekly*, 17.6.35, **78**, (1), 21.—It has been found necessary to develop an adequate supply of water for drilling purposes some distance away from the crest and flanks of the Kettleman Hills North Dome.

The water resources are pooled in this field, and two stations are in operation to supply all the needs of the field, and these were designed to supply a peak demand of about 60,000 brl. of water per day.

Electric motors and gas engines are used as prime movers, with the electrical energy being generated in the water station through the use of additional gas engines and high voltage generators. L. V. W. C.

891. Packing-Off Lines in Open Hole between Two Different Producing Horizons. N. Williams. *Oil & Gas J.*, 27.6.35, **34** (6), 17.—The setting of a screen in open 8¼-in. hole between two producing horizons has enabled the well to be produced either from the upper Cockfield through the casing or from two lower sands through the tubing.

The setting in the well was: 12-in. triple seal back pressure valve to 5131 ft., 18 ft. screen to 5110 ft., 10 ft. of blank liner to 5100 ft., 18 ft. screen to 5082 ft., 28 ft. of blank liner to 5054 ft. sealed off with the special packer to open hole, 18 ft. of screen to 5036 ft. taking in the upper Cockfield sand at 5038 ft. and blank liner into and sealed off with a packer to the 7-in. casing cemented at 5023 ft.

The setting was made in one trip, being run in on 2½-in. tubing sealed to the inside of the 5-in. liner with a tubing packer, and a special setting tool was used. L. V. W. C.

892. Handling High-Pressure Wells in the Mid-Continent. *Petr. Eng.*, May 1935, **6** (8), 52.—The subsurface conditions under which pressure exists determine the precautions that must be taken to control a well during drilling, and when the oil underground is associated with a prolific source of high-pressure gas a serious hazard exists. Sudden release of this high-pressure gas may result in dangerous flow velocities at the casing-head. To overcome any danger of this the operators in the Oklahoma City Field equipped their wells with apparatus to withstand high casing-head pressures.

In the Fitts Pool the original bottom-hole pressure was approximately 1900 lb., and the natural gas-oil ratios are sufficiently high to require care and close control in drilling.

Mud control has received considerable attention, and in some instances wells are drilled-in under pressure. L. V. W. C.

893. Heaving Shale Attempt. E. S. Post. *Oil Weekly*, 8.7.35, **78** (4), 17.—The Continental Oil Company is making an attempt to drill through heaving shale by the use of powerful drilling equipment and special type of combination casing and drill stem and a collapsible drilling bit.

The surface equipment is distinguished from the usual merely by its size; the subsurface equipment, however, is the new advancement and the main experiment.

The hole was commenced with a 7⅞-in. string, and 16-in. casing was set at 1483 ft. A string of 11¾-in. casing was set at 6504 ft., the heaving shale having been met at 6022 ft. No change was made in the equipment to drill through this portion of the shale.

The first string of drill-pipe casing was 8¼-in. inside diameter, with almost a flush joint on the inside and only a small shoulder on the outside.

A collapsible wire line bit is connected to the string permitting the removal of the bit without pulling the string.

The idea is to drill as far as possible through the strata, and should the casing become stuck the bit will be recovered and the string cemented.

A complete description of the rig set up is given. L. V. W. C.

894. Oilfield Development with Core Drills. S. O. Andros. *Oil Weekly*, 24.6.35, **78** (2), 21.—The core drill was introduced into the oil industry owing to the need for more scientific methods and greater accuracy in working out oilfield geology.

The advantages of obtaining a solid core from the strata in the territory under observation are: 1, accurate records; 2, drilling speed; 3, portability; 4, two drills in one; 5, size of hole; 6, pressure control; 7, low cost; 8, adaptability. L. V. W. C.

895. Interesting Drilling Plan being Used on Second Binger Deep Test. F. Swindell. *Oil Weekly*, 24.6.35, **78** (2), 24.—The drilling equipment in use in the Binger area, Oklahoma, is direct-current electric equipment.

Alternating current is taken at 13,200 v. and stepped down to 2200 v. through a bank of transformers. It is passed through an oil switch and used to drive the 300-h.p. motor in the power unit.

The draw-works and pumps are driven by motors rated at 275 h.p., 350 v., 1000

r.p.m. when rated for a 40-degree temperature rise in continuous operation and at 400 h.p. at a 50-degree rise for 1 hour's operation.

The larger generator drives the slush pumps and the smaller the draw-works.

The draw-works is of the unit type with six drum speeds.

The derrick is a 156-foot, 36-foot base, and permits the pulling of fourbles. A second rat hole is placed about 18 in. from the rotary table, and permits a joint of drill pipe to be set in readiness for lowering into the hole when the kelly is drilled down.

L. V. W. C.

896. California Operators Show Advancement in Technical Application. W. H. Sawdon. *Petr. Eng.*, Midyear, 1935, **6** (9), 79.—A remarkable increase in the use of surveying instruments is to be noted during the past year, and it has become evident that correcting for deviation immediately the hole starts deviating is a more economical manner of drilling.

The speed at which wells can be completed is naturally an economic factor, and it has been demonstrated that fast drilling, without loss of efficiency, is quite possible.

Methods and equipment used in mixing and pumping cement into wells have been improved, and it has become an almost universal practice to use a time-pressure recording instrument on all cement jobs done in California. By means of this instrument it is possible to record the time taken in mixing, the time utilized in pumping the cement, the pressure at any time during the operation, and the time and duration of shut-downs due to any accidents.

Electrical coring has become practically universal in application, and although this method does not supersede the mechanical coring, it reduces the amount necessary, and provides data often missed by the core barrel.

By electrical methods an estimate can be obtained of the porosity and permeability, and geological formations in the various wells in the same field can be accurately correlated.

In the production sphere new pumping equipment has been developed, and in well repair work the use of instruments shows the trend of technical advancement.

L. V. W. C.

897. The Scientific Control, Development and Production of Reservoirs. C. J. May. *J.I.P.T.*, 1935, **21**, 516–522.—The 1934 review of the above subject is given under properties of gas and reservoir crude, migration of oil, water flooding, well spacing, acid treatment, flow of oil-gas mixtures, and gas lift. G. R. N.

898. Review of Oilfield Production Practice. K. C. Selater. *Petr. Eng.*, Midyear, 1935, **6**, (9), 22.—Steady progress has to be recorded so far as oilfield production practice is concerned.

Improved types of portable pulling and cleaning-out equipment have recently made their appearance, and economies have been made by the reduction in the amount of standby equipment.

Central powers and backside cranks are in favour, as are all types of pumping equipment of the individual unit type of improved design.

Sucker rods are receiving attention, and in areas where hydrogen sulphide is bad wrought-iron rods are proving their worth.

The obtaining of subsurface samples has been examined, and the technique involved in examining and the instruments used are evidence of a rapidly developing technique which is sure to make great strides within the next few years.

The metering of oil from wells has been done, and has been shown to be a feasible method for gauging a well's production. L. V. W. C.

899. Two Wells Five Feet Apart Pumped by One Engine. Anon. *Petr. Eng.*, June 1935, **6** (10), 49.—Two wells have recently been drilled from one location, and these are being pumped with one engine. The production from the two wells is different in gravity and quantity, each hole being completed in a different producing zone. These two wells are 5 ft. apart at the surface.

The power is supplied by a 50-h.p. gas engine with fuel taken from a domestic gas line. L. V. W. C.

900. Pumping Irregularly Located Wells Solved by Line Swing. E. S. Post. *Oil Weekly*, 24.6.35, **78** (2), 30.—A shackle line swing has solved the problem of pumping several irregularly located wells in the Jacob Field, South Texas.

The material included a piece of rotary chain, 4-in. drill collar, a length of 3-in. drill stem and a gear wheel.

By means of this line swing a third well was worked up to a two-well power.

Sketches are given to illustrate the manner of operation. L. V. W. C.

901. Cause of Low Power Factor and Effect on the Capacity of a Generator. W. C. Lane. *Oil Weekly*, 10.6.35, **77** (13), 29.—This article is an explanation of the term "power factor." The author shows that it is not a fictitious quantity, but that since the power factor of the load in a generator affects its capacity materially, if more generator capacity is needed corrective measures must be applied. If an excessive amount of generator capacity and ample lines are available, power factor is of little moment, since the actual cost of producing the energy lost is nominal. L. V. W. C.

902. Hydraulic Operation Increases Efficiency and Reduces Cost of Pumping Oil. Anon. *Petr. Eng.*, Midyear, 1935, **6** (9), 28.—This article gives a full description of the Kobe hydraulic pumping method.

The method utilizes fluid operation for lifting purposes, filtering oil from the well and pumping it down through a tubing string as power oil to the production until submerged in the well, another returning this oil with the production.

The pump consists of a hydraulic power unit and the subsurface unit.

The surface unit consists of a small electric motor, a triplex pump and filter system, an operating switch and gas heater all combined into a single compact unit.

The subsurface unit consists of an engine and a production pump combined in a single unit.

By heating the power oil, the paraffin problem can be overcome and the necessity of pulling wells for this cause eliminated.

Crooked holes can be produced successfully by this method. L. V. W. C.

903. Oklahoma City Field Wells Produced by Intermittent Flow. S. F. Shaw. *Oil & Gas J.*, 30.5.35, **34** (2), 14.—The use of intermittent flow has greatly increased in the Oklahoma City Field, since there has been no other economic method when the wells have declined to a low production and when the bottom-hole flowing pressure is low.

The types of flow employed are : (1) flow through the annular space between casing and tubing, (2) flow through the annular space with packer and valve at the bottom of the well, (3) flow through the tubing without chamber at the bottom of the well.

The simplest form of intermitting is through the casing without bottom-hole device, whilst intermitting through the inner string of tubing presents considerable difficulty.

The input gas is controlled either manually or by clock attachments.

L. V. W. C.

904. Backside Crank Pumping in Kansas Fields. V. D. Bennett. *Petr. Eng.*, May 1935, **6** (8), 30.—Three factors of great importance have given an impetus to this method of production : (1) the value of salvable equipment, (2) reduction of operating and maintenance costs, (3) the reduction of initial investment where new wells are concerned.

The value of the equipment that may be salvaged from a conventional standard pumping rig by substituting backside cranks is large, and where fluid loads have been reduced to a very low figure, such substitution is essential.

Slow-speed pumping with small-diameter pumps is favoured by most operators in the Kansas Fields, since by such a combination it has been possible to operate the pumps continuously without "pounding." L. V. W. C.

905. Review of Gas Lift Operations in 1934–1935. S. F. Shaw. *Petr. Eng.*, Midyear 1935, **6** (9), 44.—A tremendous increase in gas lift operations has been made during the past year, and in some instances depths of more than 10,000 ft. are being successfully gas lifted.

When maximum production is desired, continuous gas lift is employed, and the proper size of casing and tubing advisable is beginning to receive the attention that it deserves.

Periodic flow is being employed where the capacities of the wells are greater than the daily allowable production.

For small wells the use of intermittent flow is steadily increasing. In the Oklahoma

City Field this type of flow has taken three different forms : (1) gas introduced through the tubing and producing through the annular space, (2) gas introduced through tubing, but with packer set in the annular space, (3) gas introduced through the casing and flowing the tubing with plunger lift attachment.

When wells are flowed periodically, wells with high bottom-hole pressures must be started with some form of starting valve, in order to reduce the pressures that would otherwise be required at the compressors.

Bottom-hole pressure observations are increasing, and an understanding of this important subject is gradually being evolved. L. V. W. C.

906. Examination of Oilfield Waters Essential Protective Measure. W. R. Wiggins and C. E. Wood. *Oil & Gas J.*, 27.6.35, **84**, (6), 48.—The value of water analysis to the petroleum engineer is in the opportunity it offers for the correlation of waters from well to well in a field, the identification of water appearing in a field, and the identification of water appearing in a well. Such analysis enables the intrusive water to be identified and the stratum from which it comes to be located.

The analysis is divided into three sections : (1) general preliminary treatment, (2) determination of metallic ions and (3) determination of acidic ions. The sections are explained in detail. L. V. W. C.

907. Production Technique. E. A. Satchell. *J.I.P.T.*, 1935, **21**, 523–538.—The 1934 review of production technique is described under acid treatment of limestone wells, care and operation of small wells of low pressure of the Appalachian basin, oil recovery by artificial water flooding in Bradford field, increased recovery by applying air and gas pressure to oil sand, pumping units, sucker rods, preventing cutting of oil through churning, redwood tanks for lease use, and well servicing equipment. G. R. N.

908. Flow-Line Treatment now a Reality. C. H. M. Roberts. *Petr. Eng.*, June 1935, **6** (10), 43.—Electrical resolution of crude petroleum emulsions is known as " Flow-line " treatment. The emulsified oil is conducted directly and continuously from the producing well into the dehydrator, where it is treated to pipe-line requirements.

A crude petroleum emulsion is an unstable system, and only two conditions of equilibrium are possible. In one, equilibrium is reached when the emulsion separates to continuous phases of oil and water, and in the other equilibrium is reached when the changes have practically ceased and the emulsion has attained a condition of maximum stability.

Emulsifying agents are components of the oil and marine, or both, and since they adsorb at the interface when the brine is dispersed in the oil, they must migrate from the interior of the oil or brine to that interface, and this takes time.

Since time is a factor connected with the stability of an emulsion, it is important to consider the time required to reach maximum stability.

Various difficulties occur in dehydration, but flow-line treatment overcomes all of them, since the emulsion is never permitted to come into contact with the air, nor to stop moving until after it has been dehydrated and delivered to stock.

A further saving arises with flow-line treaters from the fact that, since treating temperatures are usually lower than under the batch system, the gasoline losses are almost entirely avoided.

The flow-line system has almost completely eliminated the difficulties due to handling the emulsion prior to treatment. L. V. W. C.

909. Gas Measurement. E. E. Stovall. *Oil Weekly*, 8.7.35, **78**, (4), 20.—A discussion of barometric pressure corrections for use in the measurement of gas. This follows closely upon the findings of the " Committee for the Study of Practical Methods."
L. V. W. C.

910. Progress in the Use of Bottom-Hole Chokes. H. C. Otis. *Petr. Eng.* Midyear 1935, **6** (9), 64.—The use of bottom-hole chokes as a means of controlling flow from high-pressure wells and of eliminating the freezing that may occur has become general practice in the Mid-Continent and Gulf Coast Fields.

A mixing valve may be connected to the tubing riser in such a manner that the hot production from the tubing serves to heat the colder production passing through the valve, to obtain flexibility in the rate of withdrawal.

Various gas companies operating in high-pressure fields are making a study of bottom-hole chokes.

It has been found that bottom-hole choking reduces treating difficulties when producing from a high gas–oil ratio well which produces B.S. A blank bottom-hole choke has been used as a plug when running casing under pressure and pulled under pressure after the string was landed. L. V. W. C.

911. Compressed Gas and Air in Oil Production. R. von Zwerger. *Oel and Köhle*, 1935, **11**, 317–323.—The following applications are dealt with: (*a*) Re-pressuring, (*b*) gas drive, (*c*) gas- or air-lift, (*d*) displacement pumps, (*e*) ropeless plunger lift, (*f*) driving of long reach pumps. The scope of each is described and illustrated by reference to American and German practice.

For the most effective utilization of gas or air it is necessary to consider: (1) *Geological and Physical Principles.* Oil tectonics are briefly discussed to show that artificial maintenance of gas pressure is especially necessary when, by reason of geological structure, hydraulic production does not operate, *e.g.*, in lenticular formations bounded by impervious strata. As the natural gas pressure falls the following changes occur in the physical properties of the crude oil: Gas solubility diminishes; viscosity rises, necessitating more energy to drive oil through sand; surface tension increases, leading to retention of oil in sand; specific gravity increases and volume decreases, thus encouraging formation of gas pockets which hamper movement of oil. (2) *Stage of Production.* Applications (*a*), (*c*), (*d–e*) successively become of service as production proceeds. P. G. H.

912. Repressuring Project is Benefited by Application of Bulk Pressure. C. E. Morris. *Oil Weekly*, 10.6.35, **77** (13), 25.—A number of interesting points were gained following a repressuring project carried out in the Bush City shoestring. It was found that some wells pumped well under one certain pressure, and if this were increased or decreased, the well did not pump so satisfactorily. As a result, the wells had to be watched, and back-pressure either increased or decreased as necessary. Some wells were not affected in their pumping.

Repressuring has proved beyond doubt that it is of material benefit on this shoestring areas. L. V. W. C.

913. Higher Recoveries in Flooding Possible by Water Conditioning. A Simmons. *Oil & Gas J.*, 27.6.35, **84** (6), 34.—Absolutely clean water is a necessity in flooding systems, and even if this is used, a completely filtered water usually corrodes the pipelines to form enough rust, so that by the time the water reaches the sand the effect of filtration is partly nullified.

Various methods have been tried to limit the amount of corrosion of pipe-lines. Chemical stabilization of the water is one method tried to effect a slight scaling tendency.

Water treatment has been proposed, and the following operations are explained: (1) aeration, (2) chlorination, (3) stabilization, (4) filtration, (5) mechanical deaeration, (6) chemical deactivation, (7) secondary filtration.

The factors affecting water intake quantities can be enumerated as follows: (1) sand thickness, (2) permeability and uniformity, (3) applied pressure, (4) water quality, (5) chemical characteristics of salts in the sand, and (6) pumping cycle of oil wells. L. V. W. C.

914. Patents in Drilling Apparatus. G. G. Harrington. U.S.P. 2,000,076, 7.5.35. Roller bit.

B. E. Tyler. U.S.P. 2,000,109, 7.5.35. Oil-well swab.

J. H. Howard. U.S.P. 2,000,389, 7.5.35. Core catcher.

R. L. Aumock. U.S.P. 2,000,431, 7.5.35. Vent for gasoline tanks.

G. L. Kothny and F. C. Narvensen. U.S.P. 2,000,524, 7.5.35. Well surveying instrument.

P. G. Gates. U.S.P. 2,000,750, 7.5.35. Oil-well bailer.

G. E. Slangenhop. U.S.P. 2,001,270, 14.5.35. Combined rod guide, rod check and paraffin swab.

R. V. A. Mills. U.S.P. 2,001,350, 14.5.35. Method of chemically treating wells to increase drainage area.

E. V. McCollum and G. C. McGhee. U.S.P. 2,001,429, 14.5.35. Method of making dip determination of geological strata.

N. H. Ricker. U.S.P. 2,001,547, 14.5.35. Method of operating plunger-lift apparatus.

C. N. Scott. U.S.P. 2,001,551 and 2,001,552, 14.5.35. Plunger-lift apparatus and control device.

A. Arutunoff. U.S.P. 2,001,649, 14.5.35. Submergible electric motor for oil-well pumps.

E. A. Johnson. U.S.P. 2,001,684, 14.5.35. Pressure head for oil wells.

L. Bradley. U.S.P. 2,001,764, 21.5.35. Core drill and valve.

S. P. Ischappat. U.S.P. 2,001,946, 21.5.35. Tubing head.

J. H. Howard. U.S.P. 2,002,012, 21.5.35. Stuffing box for polish rods.

J. H. Howard. U.S.P. 2,002,062, 21.5.35. Well production apparatus.

L. E. Harrington. U.S.P. 2,002,112, 21.5.35. Dumping apparatus for wells.

C. E. Bannister. U.S.P. 2,002,385, 21.5.35. Drilling apparatus comprising a non-rotating stem, a fluid pressure motor with tool operable by this motor and means for permitting the operation of the tool independently of movement of the barrel enclosing the motor.

C. E. Bannister. U.S.P. 2,002,387, 21.5.35. Well-drilling apparatus comprising a pair of oppositely rotating bits.

C. E. Bannister. U.S.P. 2,002,388, 21.5.35. Rocker blade bit.

H. C. Otis. U.S.P. 2,002,791, 28.5.35. Method of, and means for flowing oil wells.

J. D. Nixon. U.S.P. 2,003,009 and 2,003,010, 28.5.35. Method and apparatus for producing liquid from wells.

F. W. Hild. U.S.P. 2,003,078 and 2,003,079, 28.5.35. Automatic drilling controls.

C. S. Crickmer and H. R. Standlie. U.S.P. 2,003,679, 4.6.35. Flexible pump plunger.

J. W. Sperry. U.S.P. 2,003,791 and 2,003,793, 4.6.35. Rotary disc bit.

T. Hannesschlager. U.S.P. 2,004,071, 4.6.35. Well strainer.

J. R. Vandever. U.S.P. 2,004,452, 11.6.35. Chemical heater for oil wells.

E. P. Halliburton. U.S.P. 2,004,606, 11.6.35. Multi-stage cementing process.

J. A. Kammerdiner. U.S.P. 2,005,228, 18.6.25. Torsion set rotary jar.

J. Penrod. U.S.P. 2,005,299, 18.6.35. Valve assembly for well pumps.

L. V. W. C.

Class 400. Transportation, Storage and Distribution.

915. Transportation and Storage. A. C. Hartley. *J.I.P.T.*, 1935, **21**, 539–545.—An account of literature published during 1934 on pipe-line materials and construction, pumping stations, natural gas transport, maintenance of pipe-lines and corrosion and storage. G. R. N.

916. Progress in Pipe-Lining. O. C. Jones. *Petr. Eng.*, Midyear 1935, **6** (9), 10.—The Lindeweld process for welding pipe-lines has increased the speed and efficiency with which these operations are carried out.

The possibility of both cutting up the line and building the edges in one operation and the availability of the multi-flame welding method for making good quick welds on old pipe have made this type of work practical and economical. L. V. W. C.

917. Progress and Trends in Pipe-Line Practice. S. H. Love. *Petr. Eng.*, Midyear 1935, **6**, (9), 35.—Increased activity has occurred in the construction of pipe-lines, and there has been a marked trend towards the reconditioning of old lines and the laying of new ones with salvaged pipe.

The best type of pipe coatings for particular areas have been examined and many other means for combating corrosion have been experimented with.

The procedure adopted in the reconditioning of pipe-lines has become more standardized, and various new equipment has been devised both for applying the coating and for removing it when reconditioning is necessary.

The problem of corrosion is of tremendous importance, and such materials as celluloid and vulcanized soft rubber have been tried with success.

The trend in field and trunk-gathering stations for crude oil continues towards the use of small flexible units, and readily removable gas and gasoline engines, electric motors and Diesels have largely replaced steam power.

New type gate valves have been installed on gasoline lines to reduce the friction incident to opening and closing.

Welding procedure has been improved, and increased economy, greater speeds and improved quality of welds have resulted. L. V. W. C.

918. Pipe-Joint Testing Device. E. S. Post. *Oil Weekly*, 17.6.35, **78** (1), 29.—The United Gas Public Service Company have been experimenting with a testing device for pipe using gas and giving practically the same strain as being used on the line. This prevents considerable loss through the installation of leaky joints into main lines.

The tester is made of two short pieces of pipe which have been welded and closed in one end. A gauge reading to 500 lb. and a release valve are fitted to one joint. On the other is fastened the pipe leading to the gas supply. These two short lengths of pipe are fastened on the open ends of the piece of pipe to be tested.

Gas is supplied to the pipe and the pressure read on the gauge. L. V. W. C.

919. Cathodic Protection of Pipe-Lines. N. Williams. *Oil & Gas J.*, 16.5.1935, **33** (52) 29.—A description is given of a wind-driven electrical generator unit which is used on a bad section of soil around a Dayton–Port Arthur (Texas) pipe-line, in order to provide cathodic protection from electrolytic corrosion. The generator is designed to operate with wind velocity of as low as 2 m.p.h., and is fitted with a brake which is automatically operated at 25–30 m.p.h. wind velocity. The unit is set up directly over the pipe. The ground-bed to be electrically charged is built of eight sections of junk pipe embedded firmly in the ground upright, and connected across by a welded section of pipe to which the lead-off line 1000 ft. long is anchored and supported on poles. Sufficient power is generated to be felt for 12 miles and to provide full protection for 5 miles, no leaks having been noticed in the section of line since the installation, although previously two or three leaks were found every month. The adaptability of the wind-driven generator in districts where electric current is not available is emphasized. The possibility of using water-driven generators in rivers etc. at line crossings is being considered. C. L. G.

920. Efficient Foam Protection System at Station Tank Farm. S. H. Love. *Petr. Eng.*, June 1935, **6** (10), 19.—An old-style, two-solution, wet-system foam plant has been converted into a dry-powder system.

The system which has been developed is a flexible and efficient fire-fighting unit.

A complete description of the unit is given. L. V. W. C.

Class 500. Properties and Their Determination.

921. Absolute Colour Measurements on Mineral Oils. R. Koetschau. *Oel and Köhle*, 1935, **11**, 351–361.—This paper deals with the exact measurement of colour depth and colour type in the Pulfrich Photometer, the construction of which is described. The results are used as an aid in following the effects of physical and chemical treatment of lubricating oils. D, the proportion of light transmitted, is measured, and on the basis of the Lambert–Beer law of light absorption for coloured solutions, an "extinction coefficient," $K = -\frac{1}{\log D}$, is derived. Log K is independent of the concentration of coloured material and, when determined for light of different wave-lengths (obtained by the use of a series of filters in the Pulfrich instrument), enables absolute colour curves to be drawn. $\log K_{\text{yellow}} - \log K_{\text{blue}}$ is a measure of *Colour Type*.

Log K–wave-length curves for mineral oils approximate to straight lines for yellow-blue light. K values are applied to the examination of aged lubricating oils. With the use of any one colour filter, the "extinction quotient" $K_{\text{aged oil}}/K_{\text{new oil}}$ shows remarkable proportionality to acid value, saponification values and other ageing tests. The effect of bleaching earth on oils, the degree of oxidation in artificially aged oils, and the effect of copper catalysts on such oxidations are described in relation to changes in absolute colour. P. G. H.

922. Oiliness in Motor Oils. D. P. Barnard and E. R. Barnard. *Refiner*, 1935, **14**, 324–328.—After discussion of the available evidence the authors suggest that up to the present a definite explanation of the nature of oiliness has not been evolved even

though its existence is recognized; that there is no clear-cut published evidence of effects beneficial or otherwise, of oiliness in the lubrication of the conventional internal combustion engine; that extreme pressure lubrication test conditions have no close counterparts in the internal-combustion engine, and where effects due to adsorbed film or oily lubrication are noted, the evidence indicates that these films are very thin—probably of molecular magnitude; and that direct measurements of the thickness or mass of such films are not practicable. B. C. A.

923. Micro-viscosimeter. F. M. Lidstone. *J.S.C.I.*, 1935, **54**, 189T–190T.—The article describes a viscosimeter suitable for use with very restricted quantities of liquid, *e.g.* 0·05 ml. It takes the form of a straight glass capillary of uniform bore, 30 cm. or more in length, surrounded by a larger glass tube which is filled with water and acts as a thermostat. The lower end is tapered and the whole is graduated in cm. with the exception of the bottom two or three cm., which are divided into millimetres. This portion of the tube is used to measure the capillary rise of the liquid under investigation, which is sucked up the tube and allowed to fall by gravity. The meniscus is timed between any desired marks on the tube. The author has developed an equation for use with the instrument as follows:

$$\eta = \frac{r^2 g \rho t}{8\beta(h_1 - h_2 + c \log h_1/h_2)}$$

In this equation, η, r, g, ρ and t have their usual significance, whilst h_1 equals the initial head and h_2 equals the final head, β is a drainage correction factor and c the capillary rise in cms.

Viscosities determined by this viscosimeter and an absolute viscosimeter were in good agreement. It is pointed out that the formula involves r^2, hence the instrument is not so sensitive to slight inaccuracies in the value of r as are the more usual types of viscosimeters, which contain r^4 in their formulæ. W. E. J. B.

924. Significance of Heat Conductivity of Bitumen. E. Graefe. *Bitumen*, 1935, **5**, 54–56.—The low heat conductivity of bitumen is disadvantageous in certain cases, particularly in the electrical industry. It has been found that this property can be raised by mixing with the bitumen, material of good insulating properties and high heat conductivity, particularly crystalline material such as quartz. Natural quartz sand (0·1–0·4 mm.) is better than artificially powdered quartz. The proportion of sand should exceed 60%. Although the heat conductivity increases as the proportion of sand is raised, the elasticity and fluidity decrease. The coefficient of expansion of a bitumen/quartz mixture is less than that of bitumen itself, and this is an advantage, *e.g.* when the compound is used as a substitute for transformer oil. The breakdown strength is high (greater than 150 *KV.*/cm. at 100° C.). The addition of diphenyl chloride renders the mixture non-inflammable. For road construction purposes the low heat conductivity of bitumen, however, is an advanatge. Bitumen filter mixtures have higher conductivities, and under certain low-temperature conditions this facilitates the formation of ice on the surface. A surface dressing of bitumen tends to prevent ice formation. C. C.

925. Conduction through Transformer Oil at High Field Strengths. J. F. Gillies. *J. Inst. Elect. Eng.*, 1935, **76**, 647–655.—Measurements of conductivity and power factor were made on A-30 transformer oil dried over calcium turnings. Under direct stresses above 50 and below 300 volts per mil, the relation between conduction current (I) and applied voltage (V) is given by $I = kV^m$, where $m = 3$ (approx.), whilst at above 50 and below 120 volts per mil $V = V_0 + nI$. A minimum value of 4×10^9 megohms per cm.^{3} is assigned to the specific resistance (R) of the oil at 50 volts per mil, but at higher stresses R decreases rapidly. Up to 70 volts per mil the power factor (50 cycles) of the oil is of the order 0·00005, but above this stress it increases rapidly. Although at low stresses the D.C. resistance is much greater than the effective A.C. resistance, at higher stresses the two approach equality. The S.I.C. of the oil was independent of the voltage stress to which it was subjected. It is suggested that the results obtained may be explained by a theory of ionization by collision at high stresses. C. C.

926. Volume Changes of Mixtures of Benzine, Petroleum with Alcohol, and Motor Benzole. F. Spausta. *Brenn.-Chem.*, 1935, **16**, 182–184.—The volume changes on

mixing of benzine, petroleum (B.Pt. 180–280°), motor benzole C (B.Pt. under 100° C.) were determined. With the exception of mixtures of motor benzole C with alcohol, the sp. grs. are lower than are required by the mixture law, the greatest deviation occurring with mixtures containing 50% of alcohol by volume. In the cases investigated, the deviations diminished with rising sp. gr. of the petroleum component. Motor benzole C with alcohol yields small variations, changing from a slight expansion of volume up to 40% of alcohol to a small diminution at 50% alcohol and above.

The sp. grs. of mixtures of motor benzole, benzine and alcohol were determined up to an alcohol content of 50%. In general, at a constant ratio of motor benzole, benzine, the deviation diminished with increasing alcohol content.

The sp. gr. of 50% mixtures with alcohol of ten benzines of varying boiling point were ascertained. The percentage volume expansion varied irregularly from a minimum of 0·342 to a maximum of 0·402.

The contribution concludes with a discussion of the theoretical significance of the phenomena from the physico-chemical standpoint. B. C. A.

927. Chemistry of Petroleum. D. A. Howes. *J.I.P.T.*, 1935, **21**, 435–449.—An account of progress during 1934 in the chemistry of crude petroleum, gas, gasoline, kerosine, lubricating oils, paraffin wax, naphthenic acids, sulphur compounds, resins, hydrocarbons, polymerization, pyrolysis and cracking, hydrogenation, combustion and oxidation and synthetic products. G. R. N.

928. Change in Manifold Temperature for Knock Test Advisable. Anon. *Nat. Petr. News*, 29.5.35, **17** (22), 31.—An extensive investigation into the effect of the change of manifold temperature on the octane rating of gasoline as determined by the A.S.T.M. Motor Method has been undertaken by the Detonation Committee of the C.F.R. Maintaining all other conditions standard, tests were made at temperatures of 200° F., 225° F., 250° F., 275° F. and 300° F. Two series of fuels were used: (*a*) research reference fuels, (*b*) branded commercial fuels. The results show: (1) anti-knock values increase in a straight-line relationship with a decrease of manifold temperature, the increase being about 2 octane numbers per 100° F. decrease. (2) At about 280° F. the average of the results correlate with the Uniontown 1934 ratings. (3) Reproducibility increases with decrease of manifold temperature. (4) The two series of fuels show different temperatures for a similar average correlation, the commercial series at 340° F. and the research series at 257° F. No explanation of this last phenomenon is forthcoming, since by all other tests the two series are practically identical. This and other unexplained anomalies render it difficult to make any specific recommendation for new testing temperature, and none is offered. H. G.

929. Oscillograph as Used in Engineering Problems. Anon. *Sulzer Technical Review*, 1935 (1), 1–6.—An article giving a short description of the Siemens mirror oscillograph, and some particulars of its performance in various applications, among which are the following: the cyclic variations of an engine crank, fuel pressure and needle motion in fuel system of a diesel engine, and bending stresses in a beam caused by a falling weight. C. H. S.

930. Uniontown Fuel Data Correlation at Various Manifold Temperatures. N. MacCoull, G. Edgar and D. P. Barnard (Mid-Year Meeting A.P.I. May 1935), *Refiner*, 1935, **14**, 242–248.—The prime object of this work was to determine if the A.S.T.M. anti-knock method would give better correlation with the Uniontown road data by operating at some manifold temperature lower than 300° F. While the average of all fuels in all Uniontown cars was only 0·36 of an octane number higher than by the A.S.T.M. method, some fuels showed deviations of 1 to 2 octane units; and it was thought that lowering the manifold temperature might bring these extreme cases into better alignment, while not lowering the average further from true correlation. It was found that while lowering the manifold temperatures raised the values for some fuels about twice as much as others, the anti-knock values of those fuels showing the poorest correlation by the A.S.T.M. method were, in general, changed but little more than the fuels showing good correlation.

The mean anti-knock value of all fuels tested was found to rise 2·0 octane numbers for each 100° F. fall in manifold temperature. Thus, average correlation with the Uniontown values would result at a manifold temperature of about 280° F.; whilst

at 260° F. the average deviation would equal that found for 300° F., but would be of opposite sign. In other words, while the C.F.R. Committee, in general, felt that the agreement with the A.S.T.M. method was satisfactory, any manifold temperature from 260° to 300° F. would have given an agreement as good or better.

This applies only to the average values of all fuels. An interesting feature developed was that segregation of the fuels into two groups, consisting of the branded commercial gasolines and the Research Fuels, revealed widely different results, in spite of the fact that both groups were of essentially similar composition. Average correlation with the Uniontown data for the latter group would have resulted at a manifold temperature of only 237° F., but the former group would have required 340° F., a difference of 103° F.

A secondary object of this investigation was to determine if in rating these Uniontown gasolines the deviations between different laboratories were influenced by the manifold temperature. It was found that the mean deviation was reduced as the temperature was reduced.

No recommendation for a change in manifold temperature was made. B. C. A.

931. Phase Equilibrium in Hydrocarbon Systems. VIII. Methane–Crystal Oil System. B. H. Sage, H. S. Backus and W. N. Lacey. *Ind. Eng. Chem.*, 1935, **27**, 686.—The system methane–crystal oil (mol. wt. approx. 340) was studied over the range 70–220° F. and 0–3000 lb./sq. in., in the apparatus previously described. The mixtures used ranged from 0 to 50% methane.

The apparatus used has been previously described (*Ind. Eng. Chem.*, 1934, **26**, 103, 1218). Pressure was measured to 1 lb. per sq. in., temperature to 0·2° F., quantities of methane and crystal oil to 0·1% of the mass used, and volume to 0·1%.

The results are given in the form of a table constructed from the smoothed curves drawn through the experimental points, and also a table giving compositions and specific volumes of saturated liquid mixtures.

The results are also shown graphically in various forms. It is shown that the specific volume of the liquid solution depends, at the higher pressures, on the amount of gas phase present. P. D.

932. Absorption of Ethylene by Solid Cuprous Chloride. H. Tropsch and W. J. Mattox. *J.A.C.S.*, 1935, **57**, 1102–1103.—Ethylene under pressure gives an addition compound with solid cuprous chloride of formula $CuClC_2H_4$. The dissociation pressure of this compound is 2·14 atm. at 0° C. and 19·49 atm. at 40° C.; it decomposes completely at atmospheric pressure, slowly at 25°, but rapidly at 100° C. Propene under pressure is not absorbed by solid cuprous chloride, but ethylene was selectively absorbed from mixtures containing (1) ethane and (2) propene, but the absorbed ethylene amounted to only 0·012 and 0·35 mole, respectively, per mole of cuprous chloride. W. E. J. B.

933. Induction Period in the Oxidation of Propane. W. P. Munro. *J.A.C.S.*, 1935, **57**, 1053–1054.—The reaction of propane with oxygen in a Pyrex bulb of a static apparatus shows, as does that of other paraffin hydrocarbons, a long induction period followed by a rapid reaction. With propane in excess and a total pressure of 700–800 mm. the reaction occurred at temperatures from 245° C. upwards. Increasing the partial pressure of the oxygen raised the initial reaction temperature and suppressed the tendency of the reaction to "run-away." The author describes results obtained at lower pressures, and suggests that at low pressures a surface reaction becomes predominant over a gas phase reaction. W. E. J. B.

934. Naphthenic Acids. I. v. Braun. *Chem. Z.*, 1935, **59**, 485–488.—Naphthenic acids were discovered in 1874 by Eichler, Heel and Medinger, who cracked Rumanian oils. They are extracted by 2–5% NaOH solution and isolated from the extract by dilute sulphuric acid or by salting. Tanaka and Nagai showed that their amount and quality were independent of the sulphuric acid treatment.

For purification the author prefers preparation of their primary amines. Three types exist: 1, $C_nH_{2n}O_2$, paraffin carbonic acids, C_6 to C_7; 2, $C_nH_{2n-2}O_2$, paraffin monocyclic carbonic acids, C_8 to C_{12}; 3, $C_nH_{2n-4}O_2$, paraffin dicyclic carbonic acids, C_{13} to C_{23}. These are explained as derivatives of *cyclo*pentamethylene. The carboxyl must be predominantly on the end of an alkyl group, which is itself attached to a simple or double ring. L. S.

935. Naphthenic Acids. Anon. *Chem. Trade J.*, 1935, **96**, 487.—Prof. Dr. I. v. Braun in *Chemiker Zeitung* of June 15 discusses the occurrence, chemical nature, preparation and properties of the naphthenic acids. In the crude oils from Germany, Rumania, Baku, Japan, Texas, California and Venezuela, there are three types of naphthenic acids, viz. paraffin carboxylic acids, monocyclic acids and bicyclic acids. The first type covers products with 6–7 C atoms, the second those with 8–12 and the third those with up to 23 C atoms. The chief sources of N acids are Russian and Rumanian oils, and to a smaller extent Polish oils. American and German oils produce comparatively small quantities. The content of N acids is rarely greater than 2% and is frequently lower than 0·1%, being higher in oils poor in paraffin than in those rich in paraffin. Even at an average content of 0·1%, the potential world's annual production of N acids to-day is about 200,000,000 kg.

The acids are purified technically by treatment with: fuming H_2SO_4, various oxidizing agents, aniline, toluidine, or with glacial acetic acid and petroleum ether. The acids thus obtained are almost colourless, but have a disagreeable odour. They react chemically as an ordinary monobasic organic acid. The Na salts are less hydrolysed than the usual Na soaps and have a stronger emulsifying power. The Ca, Al and heavy metal salts are soluble in benzole, benzine, and remain after evaporation as a plastic-elastic coloured mass. Technical applications of the naphthenic acids include: (1) reduction of the viscosity of colloidal solutions, (2) solution and regeneration of vulcanized rubber, (3) prevention of gelatinization of tung oil on heating, (4) as a constituent of fungicides. Naphthenic acid esters (particularly with glycerines) are used in the preparation of synthetic resins and lacquers. The sodium salts are employed to increase the viscosity and lubricating properties of oils, and to stabilize the emulsifying in water of numerous water-insoluble products. The heavy metal salts are used in the production of coating materials and driers, and the copper salts in wood preservatives owing to their antiseptic properties.

The field of application of the acids will undoubtedly be greatly expanded when methods have been worked out for the separation of the various groups of N acids. The alcohols obtained by catalytic reduction of the acids are pleasant-smelling liquids and should find many uses. C. L. G.

936. Behaviour of Unsaturated Hydrocarbons Toward the Grignard Reagent. C. R. Kinney and R. G. Larsen. *J.A.C.S.*, 1935, **57**, 1054–1056.—No direct evidence was obtained for the addition of phenylmagnesium bromide to α,α,-diphenylethylene, styrene methyl phenylacetylene and trimethyl phenylallene at temperatures varying from 130 to 300° C. W. E. J. B.

937. Analysis and Testing. E. B. Evans. *J.I.P.T.*, 1935, **21**, 416–427.—A review of published literature on the examination of petroleum products for 1934. G. R. N.

938. Laboratory Distilling Apparatus. (A. P. I. Mid-Year Meeting 1935.) W. W. Shcumann and J. F. Stewart. *Refiner*, 1935, **14**, 276–282.—Methods and apparatus are described for the laboratory evaluation of crude petroleum. The apparatus consists of the following four distillation units: (1) atmosphere distillation unit, (2) stabilizing unit, (3) flash vacuum distillation unit, (4) vacuum fractionating unit.

Operating data and characteristics of the products are given which illustrate the flexibility of the apparatus and indicate the degree of fractional separation made.

A major advantage of the equipment consists of its ability to make sharp-cut fractions of sufficient size that they can be further refined to finished products in amounts sufficient for a determination of their quality. B. C. A.

939. Fuel Specification for High-Speed Diesel Engines. G. C. Wilson. *Nat. Petr. News*, 22.5.35, **27** (21), 46.—The article deals with the significance and relative importance of the different determined properties of diesel fuel and the extent to which various commercial and official specifications cater for these properties. The development of the high-speed diesel engine has produced the need for a more closely specified fuel, and the point is stressed that future engine development must not make demands on straight-run gas-oil stocks needed for cracking because of an increased need for still closer specifications. Tables are presented which show the scope of present specifications. H. G.

940. Engine Tests of Gasoline and Diesel Fuel. R. Stansfield. *J.I.P.T.*, 1935, **21**, 428–434.—This subject is reviewed for 1934 under the sub-titles, gasoline, the C.F.R. engine, engines at high altitudes, aviation gasolines and diesel fuels. G. R. N.

941. Artificial Ageing of Lubricating Oils. S. Fachini and F. Sporer. *Petr. Zeit.*, 3.6.35, **31**, (23); Motorenbetrieb, **8** (6), 4.—The authors deal with a paper read at the World Petroleum Congress 1933.

The formation of sludge in lubricating oils is described, and is attributed to the formation of oxidation, condensation and polymerization products under the influence of heat, air or oxygen and time. Use is made of the solubility of this sludge in petroleum ether in order to determine the quantity formed. The oils are aged in the laboratory by heating in a standard porcelain dish at atmospheric pressure at 150° C. for 15 hrs. or more. After heating and cooling, the oil is dissolved in petroleum ether and the insoluble residue filtered and weighed. The point at which the sludge first separates is found to vary with the oil. In a series of oils investigated, these points were 15, 50, 75, 100 and 150 hrs. at 150° C.

The oils are divided into four classes: (1) those of less stability showing a separation of sludge after 15 hrs., the sludge increasing with time; (2) stable oils showing signs of sludge deposition after 75 hrs., (3) oils which precipitate sludge after a relatively short time, the sludge increasing slowly with time; (4) oils yielding small quantities of sludge after 150 hrs., the sludge increasing in quantity on evaporation of lighter constituents and on continuing the oxidation after 150 hrs. yielding an asphaltic mass.

Experiments were also carried out using different catalysts. The acid, saponification and iodine values were determined on the treated oils. Mixed oils showed deposits of saponifiable constituents. W. S. E. C.

942. Aromatic Constituents of Mineral Lubricating Oils. Pts. I and II. C. Zerbe and K. Folkens. *Brenn.-Chem.*, 1935, **16**, 161–165, 208–211.—SO_2 extract from an American spindle oil of asphalt base was thrice fractionated under high vacuum, and the individual groups of compounds were thereby concentrated. The molecular size and sulphur content rose with molecular weight. The chemical composition of the individual fractions was ascertained by absorption spectra, the proportion of "aromatic" carbon increasing with molecular weight of the compound. The compound types thus determined were confirmed by the thermal decomposition of the individual fraction according to the method of Fischer and Schrader. The reaction products were black, tar-like liquids, amounting to some 50% of the starting material. Distillation of that of lowest origin yielded benzole hydrocarbons, solid naphthalene, a mixture of higher aromatic fractions and anthracene, whilst the highest-boiling fraction yielded also phenanthrene and chrysene, together with a hard pitch residue in all cases.

Pressure hydrogenation, in the presence and absence of catalysts, of the SO_2 extract was investigated. Using molybdenum sulphide at temperatures of less than 400° C. in a shaking autoclave, retention of the viscous character of the oil was associated with a product of improved viscosity curve. At temperatures above 450° C. decomposition reactions predominated, leading to the production of lower-boiling benzole hydrocarbons. B. C. A.

943. Diesel Oil from the Fischer and Tropsch Benzine Synthesis and the Isolation of Individual Paraffin Hydrocarbons. H. Koch and G. Ibing. *Brenn.-Chem.*, 1935, **16**, 185–190.—A diesel oil prepared by the partial dewaxing of Kogasin II originating from the process of F. Fischer and H. Tropsch was subjected to repeated fractional distillation, whereby the normal paraffins ranging from decane to octadecane were isolated. It was concluded that the normal paraffins constitute 30–40% of the Kogasin II, the remainder consisting of the lesser-branched *iso*paraffins.

The normal paraffins thus isolated were chlorinated and the products resolved by high vacuum distillation into individual chlor-products. It is anticipated that these alkyl chlorides will serve as starting material for the elucidation of the constitution of the lubricating oils already prefaced from Kogasin II.

By cooling Kogasin II to − 11°, − 20° and − 30° C., higher-melting paraffins were separated, and diesel oils of low pour resulted. The minimum yields of diesel oils of cloud points − 10°, − 20° and − 28°, respectively, were 78%, 62·5% and 45% of the Kogasin II. B. C. A.

944. Fundamental Research on the Chemical Constitution of Lubricating Oil. A.P.I. Research Project 6 (A.P.I. Mid-Year Meeting 1935). F. D. Rossini. *Refiner*, 1935, **14**, 256–275.—Some of the available knowledge concerning the chemical constitution of petroleum is briefly reviewed. No definite, pure, individual hydrocarbon has ever been isolated from the lubricating-oil fraction of petroleum. The most effective means of separating the lubricating oil consists in the proper interlocking, combination, and variation of the physico-chemical fractionating methods of distillation, crystallization, extraction and adsorption.

The work of Institute Research Project 6 on lubricating oil, now in progress about 1½ years, is reviewed. The lubricating oil fraction of a Mid-Continent crude oil was dewaxed, extracted with sulphur dioxide, and treated with silica gel in order to obtain a stable " water-white " portion, which has been subjected to four stages of systematic distillation. When this oil has been thoroughly fractionated with respect to size of molecules, fractionations with respect to type will be made, with the aim of obtaining closely-fractionated cuts containing hydrocarbons of like size and type. When this stage of separation is reached, the way will be made clear for the ultimate separation of pure hydrocarbons. B. C. A.

945. Service Characteristics of Motor Oils as Related to Composition. (A.P.I. Mid-Year Meeting.) D. R. Merrill, C. C. Moore, Jr., and U. B. Bray. *Refiner*, 1935, **14**, 313–323.—By means of solvent fractionation, it has been possible to separate lubricating oil into typical classes of components characterized by different physical and chemical properties. The performance characteristics of these components have been studied with particular attention to: (1) wear, (2) sludge formation and other results of crank-case oxidation, (3) carbon deposition as affecting the octane requirement of the engine.

The rate of wear has been found to be a function of the paraffinicity of the lubricating oil, with the low API gravity, high VGC components showing many times the wear of the highly paraffinic fractions. No difference was found between the wear characteristics of highly paraffinic oils of wide and narrow boiling range. Oxidation stability, reflected in service in reduced formation of sludge and acidity and less viscosity change, was found to be greatly improved by thorough removal of the components of low gravity and high viscosity–gravity constant.

The change in octane requirement, due to carbon deposition in service, has been compared for typical residual Pennsylvania oils and a highly solvent-treated oil of restricted boiling range. The average rate of carbon formation with the Pennsylvania oils was equivalent to an increase in octane requirement of one octane number for each 300–400 miles driven, until the increase was about 7–14 octane numbers—beyond which point little further change seemed to occur. With the solvent-treated oil of narrow boiling range, the increase was only about one point for each 1000 miles—until an increase of two to four points occurred, after which further increase was very slow. From these results it is concluded that, in order to produce oils giving low wear and sludge formation and also low carbon deposition, it is desirable to remove not only all components of low API gravity, but also the paraffinic components of highest boiling point. B. C. A.

946. Analytical Solvent Fractionation of Lubricating Oils. (A.P.I. Mid-Year Meeting 1935.) U. B. Bray, R. C. Pollock and D. R. Merrill. *Refiner*, 1935, **14**, 307–323; *Oil & Gas J.*, 30.5.35, **34** (2), 18.—By suitable choice of conditions in solvent extraction by the multiple-batch method, an analytical procedure has been developed for solvent fractionation of oils in the lubricating oil range. This procedure makes it possible to separate an oil into a series of cuts of varying paraffinicity. The results, conveniently shown as composition curves, permit close estimation of possible yields of oil of specified quality, or give valuable information on the composition of finished motor oils.

In order to obtain the most reliable data, the following precautions should be observed: (1) choose the temperature and volume of solvent for each batch extraction to give a maximum of 4 to 6% oil concentration by volume in the extract phase, (2) allow sufficient time of agitation at extraction temperature to guarantee equilibrium between phases, (3) allow ample time of settling at extraction temperature to give complete separation of phases, and carefully avoid drawing any of the raffinate phase with the extract phase.

Examination of various stocks has shown that the differences between them are

much more in the relative proportion of the different constituents present than in the constituents themselves. By the analytical fractionation procedure developed, it is possible to determine whether any particular stock contains a sufficient proportion of oil of specified quality to make production of such oil economically feasible.

Solvent fractionation of finished motor oils shows the extent to which the low-grade components have been eliminated in the refining operations. Data on a large number of typical motor oils show a wide variation in this respect, but the absence of the low-grade low API-gravity constituents in highly refined solvent-extracted oils is very noticeable. Because of the adverse effects of such constituents on quality, the analytical results are valuable in predicting the performance to be expected in service.

B. C. A.

947. Fuel Specifications for High-Speed Diesel Engines. (Mid-Year Meeting, A.P.I. Tulsa, May 15, 1935.) G. C. Wilson. *Refiner*, 1935, **14**, 239–241; *Nat. Petr. News*, 22.5.35, **27** (21), 46.—The development of the high-speed diesel engine depends as much on proper fuel specifications as on engine design. It appears agreed that viscosity and ignition characteristics are the two most important properties. The latter is rated most generally by cetene number, defined as the percentage of cetene in a blend of cetene and α-methylnaphthalene having the same ignition quality as the fuel under test. The test must be carried out in a specified engine under specified conditions. It may be determined by bracketing the unknown between two known fuels, or from the critical compression ratio, determined on a C.F.R. engine modified to run as a diesel engine, motored at 600 r.p.m., and noting the compression ratio at which firing occurs within three seconds after the fuel has been injected, thereafter using a calibration curve.

Other tests proposed for expressing ignition quality are Diesel Index Number, which is the product of the aniline point and the A.P.I. gravity divided by 100, viscosity-gravity constant as applied by Moore and Kay, and Heptane Number.

The possibility of using known dopes to hasten ignition, according to Hubner and Murphy, is restricted. The various items included in specifications are discussed, and a bibliography of 22 references is appended.

B. C. A.

948. Influence of Bitumen on Tar. — Knipping, — Golz and Bewersdorf. *Teer und Bitumen*, 1935, **33**, 151–157.—Three bitumens were investigated in amounts of 0, 10, 15 and 20% in a German Road Tar No. 1. It is concluded that the compressibility, ductility and penetration are increased by the addition of bitumen. The penetration is affected most and the ductility least, whilst the compressibility and penetration are affected more by bitumens of higher dropping point. An increase in the bitumen content does not have the same effect on the three properties. With increased time of storage the compressibility of straight tar rises, whilst for bitumen–tar mixtures the compressibility is lower than that of straight tar after 90–180 days' storage (winter and spring), but after 270 days' storage the differences are either smaller or vanish altogether. In the case of penetration, the value for straight tar rises with increased storage time, whilst for bitumen-tar mixtures the penetration is higher than for straight tar even after 270 days' storage. The ductility of straight tar also rises with the time of storage. For bitumen-tar mixtures the values are higher than for straight tar after 90 days, almost equal after 180 days' and after 270 days' storage again become generally higher.

J. L. T.

949. Ageing of Tar in Tar/Mineral Mixtures. K. Moll. *Teer u. Bitumen*, 1935, **33**, 219–224, 231–235.—From a series of experiments on mixtures of various tars and mineral aggregates, it is concluded that, under normal conditions of mixing and storage, no appreciable change occurs in the consistency of the tar. (The latter was recovered from the mixture by extraction with carbon disulphide and comparison of dropping points made with the similar extract from the original tar.) The tars used included two 60/40 anthracene oil tars (of the higher and lower limiting viscosities), a blend of 60/40 tar with 15% bitumen, and a 65/35 enthracene oil tar. With the tar of lowest viscosity some thickening occurred. If the temperature of the tar (prior to mixing) is allowed to rise too high, thickening will also occur.

Tar extracted from road surfaces showed an increase in insoluble matter. This increase is greater than can be explained purely by evaporation of the lighter constituents. French and German work suggest that polymerization and oxidation play

only a minor part in the ageing of tars. It is concluded that the artificial ageing tests carried out in the laboratory are not directly comparable with results obtained in road practice. C. C.

950. Pitch Coke and Petroleum Coke. Anon. *Engineering*, 1935, **139**, 585–586.—The preparation and use of petroleum coke were known in 1878, whereas pitch coke was first prepared during the War, in Germany. There are two types of petroleum coke; the older is carbon from coking stills and the other is obtained from cracking operations. The former type is a hard brittle material with an oily lustre and a carbon content corresponding to $C_{100}H_4$, and is one of the purest forms of industrial carbon. It contains a small amount of ash, whilst the Mexican type contains also some sulphur. Cracking still coke has become more important than the older type because it is produced in large quantities varying from 0·1 to 25%, depending on the type of oil cracked and on the conditions of operations. The composition of the coke also varies with the oil used, *i.e.*, from 94·6 to 87·15% fixed carbon, 0·36 to 4·18% sulphur and 3·75 to 12·28% volatiles from Kentucky and Arkansas fuel oils, respectively, but the coke is always of honeycomb structure and very brittle. Pitch coke was produced in Germany during and after the War by the coking of coal-tar pitch in cast-iron retorts. When the process is carried out *in vacuo* the yields are 50–60% coke, 30–40% oil, about 5% resinous bodies, together with some gas and ammonia. Carbon electrode manufacturers prefer pitch coke because of its regularity in quality. W. A. W.

951. Testing of Rubber and Rubber-Like Materials for Oil Resistance. O. M. Hayden. *A.S.T.M. Proc.*, 1934, **34**, Part II, 635–643.—Methods employed for examining the effect on the life of rubber and rubber compounds on contact with oils and solvents are discussed. It is stated that although changes in weight and volume may be serious, they are usually less so than changes in such properties as flexibility, toughness, surface disintegration, etc. Changes in length and width can be measured fairly accurately, but measurement of thickness after immersion is impossible, and changes in other properties are at present evaluated by superficial examination rather than by mechanical tests, and results cannot, therefore, be expressed numerically. Attention is directed to the necessity for conducting tests under conditions comparable to those encountered in service. Thus, if the product is subjected to abrasive wear or mechanical stresses while in contact with oil or similar materials, the test specimen should be examined immediately after removal from the immersion medium, whilst if the product is subjected to mechanical strain some time after contact with the solvent, as is the case with gasoline loading-hose, the specimen should be allowed a period of rest prior to testing, so permitting a portion of the absorbed solvent to evaporate. A. O.

952. Patents on Analysis and Testing. F. J. Maw. E.P. 429,242, 27.5.35. A cell for optically examining or testing liquid. It is formed in two parts, which, when placed together, form a chamber for accommodating a predetermined thickness of liquid, means being provided for removing excess liquid from the chamber.

C. V. Boys. E.P. 428,496, 14.5.35. Apparatus for measuring-out gas at a predetermined rate, for use with a gas calorimeter.

H. W. Blanche. E.P. 428,568, 15.5.35. Gas analysis apparatus of the absorption pipette type, the pipettes being positioned between the measuring chamber and the storage chamber.

V. A. Schoenberg. E.P. 429,437, 27.5.35. The relative colour intensity of a liquid is determined by measuring the length of light path through a base solution, which will give the same emergent light intensity as an air path of the same length. The base solution is replaced by a test solution having the same length of light path, and the relative colour value of the test solution is determined by comparison of the intensities of the light emerging from the test solution and from the base solution. Changes in light intensity are determined by means of a standardized cell at one end of which is placed a light-sensitive means (*e.g.* photo-electric cell). W. H. T.

Class 600. Refining and Refineries.

953. Chemical and Physical Refining. G. R. Nixon. *J.I.P.T.*, 1935, **21**, 311–326.—An account of the progress during 1934 in the refining of petroleum products. G. R. N.

954. Theory of Design of Distillation Equipment. P. Docksey. *J.I.P.T.*, 1935, **21**, 327–333.—A review of publications during the past year dealing with the theory of design of distillation plants. G. R. N.

955. Cracking. G. Egloff and E. E. Crandall. *J.I.P.T.*, 1935, **21**, 344–346.—In this review the following are discussed: status, economics, the cracking reaction, liquid-vapour phase and vapour phase cracking and by-products. G. R. N.

956. Laboratory Cracking Data as a Basis for Plant Design. R. L. Huntington and G. G. Brown. *Ind. Eng. Chem.*, 1935, **27**, 699.—An apparatus is described which gives the following data: (1) yields of gas, gasoline, coke and polymers as a function of measured time temperature and pressure; (2) specific volume data. The sample to be cracked is held over molten solder in a bomb, and the amount of solder can be increased or decreased by forcing in more solder from a second bomb which acts as a storage vessel, or, alternatively, releasing molten solder through a cock on the transfer line between the two bombs. In this way the volume occupied by the sample is under control, and the volume of solder expelled measures the increase of volume of the charge.

Experiments were carried out on a combined feed from a commercial cracking plant containing 75% of recycle stock. The experimental results are summarized in a table and also in a series of graphs showing per cent. gas, gasoline, etc., produced after a certain effective time at a given temperature.

Reaction velocities were also calculated, and the figures obtained were slightly below those of Geniessi and Reuter, and of Keith, Rubin and Ward. This is to be explained by the fact that the authors used a combined feed, and not virgin gas-oil as was done by the other investigators. The decomposition of the charge is regarded as a monomolecular non-reversible reaction. The further reactions taking place among the cracked products are discussed, and the experimental data are used to calculate the reaction velocity for the decomposition of cracked gasoline into gas.

Pressure has no effect on the percentage gas formed, which is in accordance with the results of Keith, Ward and Rubin. The increase in temperature required to double the rate of gasoline formation is between 20 and 22° F. over the temperature range 744–894° F., whilst that required to double the rate of polymerization averages 33° F. Hence a high temperature and short time should be most favourable to the production of gasoline. P. D.

957. Low-Temperature Carbonization. A. B. Manning. *J.I.P.T.*, 1935, **21**, 459–463.—The literature on low-temperature carbonization of coal for 1934 is shortly reviewed. G. R. N.

958. Hydrogenation. F. S. Sinnatt and J. G. King. *Gas World*, 1935, **102** (2652), Coking Section, 61–67.—A review of the principles of hydrogenation, discussing at length the various factors affecting the process. Crude benzole can be refined by means of hydrogenation with almost negligible loss in treatment. Motor spirit and lubricating oils can be produced by the hydrogenation-cracking of a solution of rubber in hydrogenation-products boiling above 200° C., but such a process would be economic only if the raw material could be obtained at a low price. Lubricating oils can be improved in colour and sulphur content by hydrogenation-cracking at a suitable temperature; a table given shows a reduction in sulphur content from 1·36% to 0·13% at a temperature of 365° C. with 4 hrs.' contact. W. A. W.

959. Hydrogenation-Cracking of some Condensed Nuclear Hydrocarbons. C. C. Hall. *J.S.C.I.*, 1935, **54**, 208T–217T.—This paper describes the behaviour of indene, and certain simple homologues of naphthalene and benzene, in the presence of hydrogen at high temperatures, *e.g.*, 300–500° C., and high pressures (220–250 atm.), with supported molybdenum oxide and sulphide catalysts. In general, the materials were maintained at the reaction temperature for 2 hrs. With 1- and 2-methylnaphthalene and 2 : 6-dimethylnaphthalene little or no reaction occurred at 450° C. in the absence of a catalyst. With the molybdenum oxide catalyst at 400° C., the monomethylnaphthalenes were hydrogenated to the extent of 85–90%, and the dimethylnaphthalene to 60%. The main product was the corresponding *ar*-tetrahydromethylnaphthalene. Above 400° C., tetrahydro-1-methylnaphthalene decomposes forming a series of *m*-alkyltoluenes. With indene, in the temperature range 300–500° C.,

from 30 to 50% of the material treated is converted into more complex products by polymerization and condensation. At lower temperatures, truxene $(C_9H_6)_3$ and liquid polymers predominate. Hydrindene is formed, and above 400° C. is decomposed to yield benzene hydrocarbons, mainly toluene. The only observed effect of the molybdenum catalyst on the reactions of indene occurs at temperatures above 450° C., when further polymerization of resins to pitch-like bodies is inhibited and stable viscous oils are produced therefrom, *e.g.*, boiling 230–360° C. Ethylbenzene decomposes in the absence of a catalyst yielding benzene and ethane as the sole products. At 480° C., *ortho*-xylene yields 47% toluene and 2% benzene, ethylbenzene yields 32% of benzene and toluene yields 13% of benzene. Hence toluene is more stable than ethylbenzene and *o*-xylene, and it is concluded that dealkylation is facilitated by increase in the number of carbon atoms in the side-chain and also by the proximity of other alkyl groups. With *n*-butylbenzene, the main reaction appears to be scission of the butyl chain to form ethane and ethyl benzene.

Pictorial representations of the main reactions involved are furnished.

W. E. J. B.

960. Progress in Hydrogenation of Petroleum and Economic Comparison with Cracking. R. P. Russell, E. J. Gohr and A. J. Voorhies. *J.I.P.T.*, 1935, **21**, 347–365.—An authorative article on the advancements made during the last three years in the production of gasoline from gas oil by hydrogenation. G. R. N.

961. Solvent Recovery. A. Boecler. *Chem. Z.*, 1935, 495.—The economical factors to be considered in estimating the value of solvent recovery methods are: (1) maximum recovery of the used solvent, (2) costs for investment and operation, (3) eventual change of existing processes.

The recovery of a smaller amount of solvent often results in greater profit than is attained by recovering the possible maximum.

If small amounts of solvents are to be recovered, the costs of adsorption and absorption plants are too high, and outer- and inner-condensation systems prove more economical.

All solvent recovery systems using condensation are based on slow movement of air which is rich in solvent vapours.

The principal differences between outer and inner condensing systems, and their advantages compared with adsorption and absorption systems are illustrated; their investment and working costs are lower, there is no wear, no necessity for special attention, no replacement of the spent adsorbent and adsorbents or roasting.

Adsorbent and absorbent plants circulate great volumes of (for the most part fresh) air. Condensing plants, on the contrary, circulate continuously the same quantity. The presence of water vapour in the fresh air necessitates heavy expenditure on calories and energy.

With condensing plants, higher working temperatures are possible, as no film formation occurs on the surfaces and therefore drying is accelerated. L. S.

962. Modern Contact Pressure Filtration. C. E. Mosmann. *Petr. Zeit.*, 3.6.35, **31** (23), 1–7.—A new process is described in which the flow of oil through the contact mass is increased and the bleacher used is ground to 200 mesh. The latest types of Kelly and Sweetland filters are detailed and schematic diagrams and photographs of these filters are given. W. S. E. C.

963. Vacuum Refrigeration System. F. L. Kallam. *Refiner*, 1935, **14**, 199–201.—Improvements in component efficiencies have favourably affected the standing of vacuum refrigeration units.

Vacuum refrigeration units will produce chilled water having a temperature of 32° F. or above. Below 40° F. the pressure to be maintained in the evaporator closely approaches a perfect vacuum, and the steam and water requirements are correspondingly high. For somewhat higher temperatures, viz. between 40° F. and 60° F., only a moderate vacuum is required, and the consumption of steam and water decreases rapidly. It is within this range that the economies of the vacuum refrigeration system are most apparent. Units designed for temperatures below 40° F. are, however, entirely satisfactory, and compare favourably in operating costs with conventional mechanical systems. B. C. A.

964. Refining of Lubricating Oils with Furfural. (A.P.I. Mid-Year Meeting 1935.) G. R. Bryant, R. E. Manley and B. Y. McCarty. *Refiner*, 1935, **14**, 299–305; *Oil & Gas J.*, 16.5.35, **33** (52), 50.—A description is given of the operation and development of the furfural refining process as applied commercially to the manufacture of high-quality lubricants from distillate stocks derived from Mid-Continent pipe-line crude and ranging in viscosity between 40 and 180 sec. Saybolt Universal, at 210° F.

The most recent design of a furfural refining unit is described and a flow diagram presented.

Solvent losses have been 0·038% of the total solvent distilled in the commercial unit.

Direct operating costs have been approximately $0·1739 per brl. of charge to the furfural refining unit.

Investment costs vary between $70 per brl. of daily capacity for the 5000-brl. units to about $300 per brl. for a 500-brl. plant.

The finishing steps employed consist in acid-treating raffinate with 2 to 5 lb. per brl. of 98% acid, contact neutralizing with 4 to 12 lb. per brl. of clay, and dewaxing with acetone-benzole to a pour below 0° F. The light acid treatment is considered more efficient and economical than straight percolation, although a satisfactory product can be made without the use of acid.

Lubricants manufactured by furfural refining have given excellent service performance, and have shown unusually high resistance to oxidation and sludging.

Pilot-unit tests are shown illustrating the application of furfural refining to a variety of lubricating stocks. B. C. A.

965. Performance and Flexibility of the Duosol Process. M. H. Tuttle. *Oil & Gas J.*, 23.5.35, **34** (1), 13; *Refiner*, 1935, **14**, 289.—There are now eight Duo-sol plants in operation and under construction in the world. The stocks treated range from light distillate to residual oils of high viscosity, and it has been shown that plant results have duplicated pilot-plant operation in quality and yield of product. For the last two years the pilot plant has been in continuous operation, treating seventy-five stocks of varying origin and properties. Some typical analyses of charging stocks, solvent rates, analyses of the paraffinic oils before dewaxing and of naphthenic fractions obtained, and analyses of the final dewaxed lubricating oils are given. The improvements in the charging stocks in respect of stability, carbon residue, sulphur content, colour and viscosity index effected by the process are shown. The results on the pilot plant also indicate the flexibility of the process in respect of charging stock which can be treated, and in the quality of the final oil, which can be varied at will. The theory of the extraction of oils by two solvents having a limited miscibility in each other is outlined. Reasons for the selection of creeylic acid as the principle constituent of "Selecto" to be used in conjunction with propane are given. Results of oxidation tests carried out on Duo-sol treated Mid-Continent residuum are compared with similar results on conventional Penna and Coastal oils to show the superior stability of the Duo-sol treated oil. R. A. E.

966. Recent Developments in Chlorex Extraction. D. B. Williams. *Oil & Gas J.*, 16.5.35, **33** (52), 54; *Refiner*, 1935, **14**, 283.—Data are presented in tabular form on the results obtained by the seven commercial Chlorex plants at present operating in the U.S. These plants have a total capacity of over 6000 brl. of oil per day handling Salt Creek, Mid-Continent and Pennsylvanian oils. The plant yields and viscosity indices of raffinates and stocks are given as:

Stock.		Raffinate (unfinished).	
Type.	V.I.	Yield.	V.I.
Penna Neutral	109·1	92·1%	117·5
Penna steam refined cylinder stock	109	93%	112·0
Mid-Continent distillate	60·5	71·5%	92·5
Distillate blend from Coastal crude	21	64·8%	65·5
Mid-Continent Bright Stock	80	87·5%	89
Oklahoma City Long Residuum (deasphalted and dewaxed)	65·5	58%	94·6
Oklahoma Long Residuum (acid treated)	—	69·2%	—
Mid-Continent Residuum	81·9	72·4%	98·7

In addition to improvement in colour, V.I., oxidation resistance, carbon residue content, emulsion test, etc. (details given), Chlorex treatment presents the following advantages :—

(*a*) Oil percolation yields are increased (*e.g.* 446–562 gals. per ton).

(*b*) The present demand for lighter oils and surplus of bright stocks is met by Chlorex extraction of bright stock, which gives a lower viscosity oil, enabling more to be used. Alternatively, a heavier bright stock can be made, giving more wax-bearing distillate from which light neutrals can be made. It is calculated that thereby 2–2½% on the crude oil of bright stock is transferred to neutral oils production.

A flow diagram and operating details are presented of the latest type of extraction equipment and vacuum distillation for continuous recovery of the solvent from the raffinate and extract fraction.

Four Chlorex plants using stills already available in the refinery for recovering the solvent were built at an out-of-pocket cost averaging $41 per brl. A new 1000 brl./day plant incorporating continuous vacuum distillation solvent recovery plant may be installed at a cost of $120–180 per brl. and a 500-brl. 1-day plant for $80–110 per brl. Operating costs in plants with continuous vacuum distillation equipment will range from 0·4–0·5 c. per gal. of oil charged, including steam, water, electricity, fuel, Chlorex loss, maintenance, depreciation and labour. C. L. G.

967. Natural Gas and Natural Gasoline. T. Hoffman. *J.I.P.T.*, 1935, **21**, 366–370.—A review of literature published during 1934 on natural gas and natural gasoline. G. R. N.

968. Light Distillates. J. S. Jackson. *J.I.P.T.*, 1935, **21**, 371–374.—This subject reviewed for 1934 under the sub-titles oxidation, spontaneous ignition temperatures, detonation, lead tetraethyl and gum. G. R. N.

969. Gas Polymerization. C. O. Willson. *Oil & Gas J.*, 2.5.35, **33** (50), 16.—The production of gas from cracking operations in the U.S.A. totals 300 billion cu. ft. per annum. By polymerization it is possible to produce from the olefines in this gas 1 billion gallons of gasoline, or more than 5% of the present U.S.A. production of motor fuel. By pyrolysis of the paraffin hydrocarbons in the gas to form olefines an even larger production of motor fuel is possible from this source. At a recent meeting of the American Chemical Society, C. R. Wagner described results obtained in laboratory, semi-commercial and commercial installations. The latter was a unit designed to handle 5 million cu. ft. of gas a day, and has produced more than 400 gals. a day of material having a boiling range similar to gasoline. A flow chart of the plant is provided. A smaller plant operating at 650 lb. pressure and at a temperature of 1000° F. on gases containing 2–17·9% ethylene and 21–37·2% propylene, produced a gasoline having I.B.Pt. 92° F., 50% over at 201° F., E.P. 398° F., Reid V.P. 10·0 lb., octane number A.S.T.M. 78·0 and C.F.R. research method 96.

In a paper by V. N. Ipatieff, B. B. Corson and G. Egloff, information was given regarding a pilot plant which employs " solid " phosphoric acid for polymerizing the olefines. A plant designed to handle 3 million cu. ft. of vapour-phase cracked gas daily and operating on this principle has been built. A yield of 3½ gals. of gasoline of high octane number from 1000 cu. ft. of gas is claimed for this process. Results of operations carried out on gases containing about 65% of ethylene, propylene and butylene show a yield of 6·3–7·1 gals. of gasoline per 1000 cu. ft. of gas. The properties of the gasoline were : S. G. 0·738, sulphur 0·04%, octane number C.F.R., motor method 82, Reid V.P. 5·2 lb., I.B.Pt. 142° F., 50% over at 266° F., E.P. 414° F. The octane blending value, C.F.R. motor method, was 116 in 25% admixture with A–3 reference fuel. R. A. E.

970. Polymer Gasoline. V. N. Ipatieff and G. Egloff. *Oil & Gas J.*, 16.5.35, **33** (52), 31.—Results of experiments carried out on five samples of cracked gases in semi-commercial polymerization units are described. The operating conditions of gas rate, temperature and pressure varied from 0·05 to 11·4 cu. ft. per hr. per lb. of catalyst, 450° F. to 500° F., and 100–175 lb. per sq. in. gauge pressure. The yields of liquid polymer ranged from 3·0 to 8·4 gals. per 1000 cu. ft. with olefin polymerization of 71–99%. The first run shows that unless H_2S is removed from the gases, the polymer gasoline will contain a high proportion of sulphur, mainly in the form of mercaptans.

Tests run on stabilizer gas from Mid-Continent gas oil, varying contact time and pressure show that with longer contact time, a greater degree of conversion is obtained, but the product is less volatile, although the octane rating is unchanged at 80–82 by C.F.R. motor method. Operating data, gas analyses and analyses of gasolines are given in all cases. It is shown that volatility has practically no effect on anti-knock value of the polymerized gasolines. In spite of the lower octane rating of the polymerized gasoline, its blending value is higher than those of benzole or *iso*-octane when mixed in proportions up to 25% in various types of straight-run and cracked gasolines. The effect is greater in the case of gasolines of lower anti-knock, *e.g.* in a 45-octane gasoline the blending value of the polymerized gasoline is 117–125, whereas in a 65-octane number gasoline the value is 103–105.

The crude polymer gasoline has a low oxygen bomb stability, induction periods ranging from 35 to 60 mins. However, it is very susceptible to addition of inhibitor, and it has been found that 0·01% of wood distillate inhibitor is generally sufficient to impart adequate oxygen bomb stability, viz. 200–300 mins. R. A. E.

971. Lubricants and Lubrication. S. J. M. Auld. *J.I.P.T.*, 1935, **21**, 379–385.—Investigations on lubricants and lubrication during 1934 are reviewed. G. R. N.

972. Asphalts and Road Materials. A. Osborn. *J.I.P.T.*, 1935, **21**, 393–401.—An account of literature published during 1934 on the manufacture, application, testing and specifications of, and the chemical and physical properties of asphaltic bitumen. G. R. N.

973. Asphalt Production. N. Meyer. *Chem. Z.*, 1935, 456.—Batch distillation under high vacuum necessitates a long heating, whereas modern pipe still combined with equilibrium vaporization yields asphalt at a substantially lower temperature, and after a very short heating, by combining atmospheric topping with a high vacuum unit.

When only warm cooling water is available, a pre-ejector is interpolated between the partial and the barometric condenser for condensing the water vapour and the uncondensed components which the partial condenser has been unable to condense. L. S.

974. Manufacture, Packaging and Shipping of Oxidized Asphalt. Article 5. C. J. Holland. *Petr. Eng.*, June 1935, **6** (10), 26.—A description is given of an asphalt plant at Hamburg consisting of two 2500-brl. combination atmospheric and vacuum pipe-stills, and two 600-brl. horizontally placed batch stills 14 ft. diam. by 30 ft. long. The plant processes Ebano-Panuco crude producing 6 grades of steam refined and 6 of blown grades of bitumens. Tables are given showing (1) plant yields of products from the distillation of 12° A.P.I. Mexican crude, with estimated costs and realizations, (2) typical analyses of four grades of blown asphalt as manufactured in 1930, (3) standard specifications of the six blown grades marketed in Germany in 1934, and (4) typical analyses of steam refined asphalts produced in the refinery. Flow sheets of the atmospheric, vacuum and oxidizing stills are reproduced. C. L. G.

975. Water-White Hydrocarbons from Asphalt. H. T. Gaetz. *Ind. Eng. Chem.*, 1935, **27**, 647.—A procedure found to be suitable for the preparation of water-white hydrocarbons from Trinidad asphalt is given. A primary separation of the asphalt into petrolene and asphaltene fractions was effected by fine grinding and solution in petroleum ether. The olive-green petrolene recovered after evaporation of the solvent was vacuum distilled into three fractions and an almost solid residue. Each fraction was treated with 98% sulphuric acid, neutralized and dried, and then vacuum distilled again to give water-white distillates. The final treated fractions have remained water-white for more than two years, and their properties are being studied. W. H. T.

976. Gas Oil, Fuel Oil, Etc. W. A. Woodrow. *J.I.P.T.*, 1935, **21**, 386–392.—Diesel fuels, carburetting gas oil, wash oils, heavy fuel oils and miscellaneous fuels are reviewed for 1934. G. R. N.

977. Kerosine and White Spirit. W. H. Thomas. *J.I.P.T.*, 1935, **21**, 375–378.—A resumé of published work on kerosine and white spirit for 1934. G. R. N.

978. Special Products. C. Chilvers. *J.I.P.T.*, 1935, **21**, 402–415.—This 1934 review gives an account of hydrocarbons and their derivatives, paraffin and other waxes, insulating oils, carbon and silica blacks, dry cleaning and other solvents, special lubricants, cutting oils, naphthenic and sulphonic acids, insecticides and miscellaneous products. G. R. N.

979. Allotropy and Corrosion. E. Cohen. *De Ingenieur*, 1935 (25), Mk. 13.—Quantitative experiments are described which show that the rate of allotropic change in tin is influenced by mechanical deformation prior to exposure to conditions favouring transition. White tin, which was held at — 50° C. immediately after "working," passed more quickly into grey tin than was the case when it was first tempered by heating. Most metals exhibit allotropy, and, since the change is usually accompanied by changes in volume and in surface, mechanical pre-history may be an important factor in corrosion problems. P. G. H.

980. Alloyed Cast Irons in Petroleum Refining Equipment. Pts. I and II. J. S. Vanick. *Refiner*, 1935, **14**, 171–179 and 221–226.—A detailed review of the potentialities of alloyed cast irons in the solution of problems of wear and corrosion associated with the operation of petroleum refinery equipment. B. C. A.

981. Steel Embrittlement. H. Vollbrecht and E. Dittrich. *Chem. Fabr.*, 1935, 193.—Investigation of the embrittlement of steels under high pressure and temperature by hydrogen and by hydrogen sulphide showed that hydrogen corrosion is heavier than that of hydrogen sulphide. It appeared that the sulphides formed effected a certain resistance against attack by hydrogen. L. S.

982. Patents on Plant. I.C.I. E.P. 428,855, 21.5.35. A process for the protection of metals against oxidation at high temperatures. Successive layers of nickel and aluminium are applied to the surface of the metal, the nickel layer being applied by hot rolling. W. H. T.

I.C.I. Ltd., M. Jones and W. F. Smith. E.P. 428,052, 7.5.35. Preparation of flexible, oil-resistant rubber composition of high tensile strength by vulcanizing a mixture of rubber with the plastic polymer of 2-chloro-1 : 3-butadiene.

F. E. Bancroft & Assocd. Elec. Industries, Ltd. E.P. 428,719, 17.5.35. Improvements in vacuum distillation apparatus consisting in mounting the sump on the distributors to which it is connected so as to enable levelling of the sump.

A.P.O. Co. & V. Laycock. E.P. 428,778, 13.5.35. An improvement in the nozzle of hoses used in the extinguishing of oil fires is described in which the nozzle is mounted and adapted to be rotated on its pivot pin.

Carborundum Co. Ltd. E.P. 429,616, 4.6.35. A process is described for the manufacture of silicon carbide packing materials. The carbide is mixed with a temporary binder and the mixture moulded into shapes which allow the passage of vapour and liquid. The shapes are heated in a non-oxidizing atmosphere to the temperature of recrystallization of the silicon carbides.

M. Barthel & Co. G.m.b.H. E.P. 429,720, 5.6.35. Mineral oils, resins, wax, fatty acids, etc., are distilled under high vacuum (8 mm. Hg) or less, and allowed to trickle over Raschig rings. The vapours evolved are passed away for refining treatment.

J. Perl. U.S.P. 2,003,306, 4.6.35. A method and apparatus for high vacuum distillation of mineral oils are described in which vapour head effects are eliminated by fractionally condensing the vapours during their downward travel from the distilling zone in order to accomplish further reduction of pressure on the distilling surface. The uncondensed vapours are continued downward to a point of removal from the system.

F. W. Hall. U.S.P. 2,005,316, 18.6.35. Dephlegmation of hydrocarbon oil vapours.

D. E. Stines. U.S.P. 2,006,186, 25.6.35. Rectifying process for the separation of relatively high- and low-boiling compounds from a mutual solution of the two. W. S. E. C.

Standard Oil Co. D.R.P. 611,049, 18.3.30. Material for coating metal tubes to conduct heated fluids are prepared from fibrous ribbons comprising 10–20% of bitumen, 75–90% of crushed rock (containing 25% of grains coarser than 0·3 mm. and 15–20% of grains finer than 0·08 mm.).

K. Kresse, F. Rehn. D.R.P. 604,293, 28.2.31. Gas-generator operated by an electric turbo-compressor attached to the top of the carburettor.

Goodlass, Wall & Lead Industries. D.R.P. 612,705, 12.6.31. Chamber filter for separation of suspensions in fluids.

Cie. pour la Fabrication des Compteurs. D.R.P. 610,316, 13.1.33. Introduction of one liquid into another is regulated by different pressure meters which are controlled by a regulating device.

Otto & Co. D.R.P. 612,009, 8.12.31. Plant for the production of carburetted water gas. Cf. D.R.P. 609,382.

Pat. Aktiebolaget Gröndal-Ramèn. D.R.P. 614,175, 18.4.30. Rotatable means for the introduction of gases into liquids.

Bartlett Hayward Co. D.R.P. 612,706. Filter fitted with rotating and oscillating devices to effect thorough stirring of the contents. L. S.

983. Patents on Cracking. K. R. Finsterbusch. E.P. 428,475, 14.5.35. A combined cracking and polymerization process in which a cracked distillate is mixed with a condensate obtained from the cracked gases to form a mixture from which hydrocarbons having 3 and 4 carbon atoms to the molecule are removed and subjected in the liquid phase to polymerization.

Scottish Gas Utilities Corpn. E.P. 428,526, 13.5.35. Oxybodies are removed from hydrocarbon materials by heat treatment at 350–400° C. and 400 lb. per sq. in. for 30–60 minutes. Water is subsequently removed from the products of reaction.

J. B. Heid. U.S.P. 2,003,536, 4.6.35. A cracking process in which water is continuously supplied to the surface of the unvaporized oil in the lower portion of the reaction zone. By this means, the vapour tension of the residue is increased and vaporization of the light components is assisted.

J. B. Heid. U.S.P. 2,003,537, 4.6.35. A combined topping and two-stage cracking process. The cracking stock for the high-pressure stage is reflux condensate obtained from cracked products and from the reduction of the crude. The cracked and crude residues are subjected to milder cracking conditions in the second stage.

W. F. Sims and V. U. Cloer. U.S.P. 2,003,724, 4.6.35. Vapour-phase cracking in which the flash chamber and cracking coil are operated under sub-atmospheric pressure.

W. M. Stratford. U.S.P. 2,003,776, 4.6.35. Liquid-phase cracking, the stock being a distillate obtained from crude or residue as a result of heat exchange with hot cracked vapours.

C. P. Dubbs. U.S.P. 2,004,196, 11.6.35. A process in which the volume of oil being converted remains constant, whilst the quantity of raw oil, the degree of cracking and yields of gasoline and pressure distillate can be varied.

F. M. Pyzel. U.S.P. 2,004,217, 11.6.35. A cracking process in which high yields of products are obtained with a minimum of coke and fixed gases. The minimum of liquid is maintained in the reaction chamber, and oil and vapour are caused to travel downwards through the large vapour space of the chamber.

J. D. Seguy. U.S.P. 2,004,223, 11.6.35. A combined liquid- and vapour-phase system, the reflux from the liquid-phase section being cracked in the vapour phase and the products returned to the primary reaction zone to assist in the conversion of the original stock.

V. Voorhees. U.S.P. 2,005,118, 18.6.35. Vapour-phase cracked products are scrubbed with some of the original distillate oil in order to remove tarry products of cracking, which are subsequently reduced to coke.

G. Armistead. U.S.P. 2,005,309, 18.6.35. Cracking of acid-free sludge obtained in the refining of lubricating oil.

J. G. Alther. U.S.P. 2,005,527, 18.6.35. A combined topping, distillation and cracking process for the production of lubricating oil and motor spirit of high anti-knock value.

F. W. Hall and H. A. Smith. U.S.P. 2,005,675, 18.6.35. A process in which the cracking stock is mixed with cracked vapours and the mixture fractionated to produce a gasoline fraction and a heavy fraction composed of partly converted and fresh oil, for cracking in the vapour phase.

H. Sydnor. U.S.P. 2,006,188, 25.6.35. Oil is heated to cracking temperature and passed downwardly through a plurality of cracking zones of large cross-section.

E. W. Brocklebank and W. B. Mitford. E.P. 429,757, 28.5.35. Combined distillation and cracking at atmospheric pressure of finely divided solid carbonaceous material intimately mixed with oil. The apparatus used is an inclined, rotating, externally heated retort, the distillation being assisted by the admittance of steam to the retort. W. H. T.

984. Patents on Hydrogenation. Gas Light and Coke Co. E.P. 428,413, 13.5.35. Adsorbents such as activated charcoal may be reactivated by hydrogenation with coal gas, previously freed from hydrogen sulphide and benzole.

Int. Hydn. Pats. Co. E.P. 428,749, 17.5.35. A process for the destructive hydrogenation of coal in the presence of catalysts, in which the initial material is freed from ash and treated with substances having an acid reaction, prior to hydrogenation.

E. I. Du Pont de Nemours & Co. E.P. 428,940, 22.5.35. Hydrofurfuranes are prepared by catalytic hydrogenation of furfurane in the liquid phase at 100–200° C. and at 50–250 atm. in the presence of an organic solvent (*e.g.* alcohol or a liquid saturated hydrocarbon).

C. Krauch. U.S.P. 2,005,192, 18.6.35. Destructive hydrogenation of carbonaceous substances at 300–700° C. and at least 20 atm. pressure in the presence of a catalyst containing uranium.

E. B. Peck. U.S.P. 2,006,177, 25.6.35. Heavy oil is cracked and the gas-oil product hydrogenated in contact with a sulphactive catalyst in the vapour phase at 900° F. and at least 20 atm. pressure. The amount of hydrogen is sufficient to cause the avoidance of coke formation, but insufficient to produce saturated products.

W. H. T.

H. Schmalfeldt. D.R.P. 613,507, 23.5.32. A furnace for the production of hydrogen by the conversion of methane containing coke-oven gases by means of water vapour and air, at elevated pressure without catalysts at 1300° C. and above.

I.G. Farbenind. A.-G. D.R.P. 614,859, 19.6.28. Reduction of pressure in hydrogenation processes is effected in two stages. In the first, a gas containing 50–60% of hydrogen is removed, and in the second the remaining gas is treated with solvents or absorbents.

L. S.

985. Patents on Crude Oil. H. Suida, H. Pöll, A. Novak. Austr. P. 141,514, 15.12.34. Hydrocarbons are separated into paraffinic, naphthenic and aromatic constituents and simultaneously refined by extracting crude oil, distillate, or residuum with a mixture of water-free crude cresol with about 10–25% by weight of nitrobenzole at normal, elevated or reduced temperature whereby all naphthenic or gummy or gum-forming constituents are dissolved, whereas the insoluble and thereby refined paraffinic constituents are separated. By saturating the extract with water, the purified insoluble naphthenic constituents are precipitated, the aromatic, gums and gum-forming constituents remaining dissolved.

H. Suida, H. Pöll, A. Novak. Austr. Appl. 7173, 15.12.33. The naphthenic and aromatic constituents of mineral oil are extracted by crude water-free cresol. The extract is then saturated with water, whereby the naphthenic constituents are quickly separated, whilst the aromatic and resinous constituents remain dissolved.

L. S.

986. Patents on Motor Spirit. Nat. Benzole Co. E.P. 428,931, 22.5.35. Benzole is purified by treatment with a mixture of solid caustic alkali and methyl alcohol, in the proportion of 1½ lb. of alkali to 1 gal. of alcohol.

M. E. Bretschger. U.S.P. 2,004,849, 11.6.35. A method of refining light hydrocarbon distillates, comprising the addition of hydrogen peroxide, followed by agitation of the mixture. Sufficient sulphuric acid (60° Bé.) is added during agitation to dissolve the oxidized sulphur compounds, but insufficient to combine with the aromatic hydrocarbons present. The acid is finally separated from the distillate.

W. H. T.

987. Patents on Gas. J. Y. Johnson (I.G.). E.P. 428,059, 30.4.35. A process for the removal of weak gaseous acids (H_2S and CO_2) from gas mixtures. The latter are scrubbed with a solution of an alkali metal or alkaline-earth metal salt of an amino-carboxylic or aminosulphonic acid capable of forming alkali metal or alkaline-earth metal salts readily soluble in water.

G. E. Seil. E.P. 429,321, 28.5.35. A porous granular material for gas purification consisting of an alkali ferrite which, in the presence of water, decomposes into a soluble compound and ferric oxide. The latter remains substantially in the original size and shape of the granules and is highly porous.

W. H. T.

E. Haber. D.R.P. 601,501, 28.4.32. Apparatus for the separation of solids and fluids from gases.

Gew. M. Stinnes. D.R.P. 613,615, 18.11.32. Desulphurization of coal gas by

means of bog iron ore (Lux-Masse). An automatic measuring device controls the oxygen content of the finished gas and regulates the admittance of air to the crude gas. L. S.

988. Patents on Lubricating Oil. A. J. Paris. E.P. 428,971, 22.5.35. Improvement of lubricating oils by introducing into them products of combustion from an internal-combustion engine which have been cooled to a temperature below which the oil will crack under the existing conditions.

P. Davie. E.P. 429,093, 20.5.35. An apparatus and method are described for the selective separation of oil from contamination constituents by means of a surface tension dialyser.

J. Y. Johnson. E.P. 428,936, 17.5.35. Solvent extraction of lubricating oils using nitrobenzene, dichloroethyl ether esters of aliphatic alcohols, liquid sulphur dioxide or propane. W. S. E. C.

Atlantic Refining Comp. D.R.P. 613,665, 22.1.32. Separation of higher-boiling hydrocarbon fractions into two fractions, one paraffinic and the other naphthenic, by means of benzonitrile.

C. C. Wakefield & Co. Austr. P. 141,869, 9.3.33. Treatment of lubricating oils with an organic compound of tin or lead, *e.g.* tin oleate, lead tetraethyl, etc.

I.G. Farben. D.R.P. 614,605 (612,717). Improvement of mineral, animal or vegetable oils by adding 0·01–0·5% of a perylene, *e.g.* 3 : 9-diacetyl- or dibenzoyl-perylene. L. S.

Sulflo Corporation of America. E.P. 428,463, 10.5.35. Production of stable suspensions of different colloidal and non-colloidal particles in various less dense liquids, in particular of lubricating oils containing stable suspended sulphur particles. The same process can be applied to a selenium lubricant.

S. Wright. E.P. 428,762, 7.5.35. A process is described for purifying and recovering oil in which the impure oil is heated under agitation in the presence of a coagulating agent to coagulate colloidal carbon. The oil, after separation of impurities and sediments, is heated under vacuum in a still to expel light spirit or moisture, treated with a decolorising earth and filtered.

F. X. Govers. U.S.P. 2,003,664, 4.6.35. Separation of wax from lubricating oil by solvent extraction using acetone and benzol.

E. F. Pevere. U.S.P. 2,003,667, 4.6.35. Dewaxing of lubricating oils using *cyclo*hexanone.

J. F. Weir. U.S.P. 2,005,062, 18.6.35. Dewaxing of lubricating oils for reduction of pour point, by adding the wax adherent medium to the oil after chilling so as to coat and separate the solidified wax particles.

L. D. Jones. U.S.P. 2,005,342, 18.6.35. Acid-treatment of lubricating oils.

C. E. Adams and V. Voorhees. U.S.P. 2,005,984, 25.6.35. Continuous closed pressure filter for separating wax from oil, using propane.

B. K. Brown. U.S.P. 2,005,988, 25.6.35. Dewaxing of lubricating oils using a non-miscible refrigerant, *e g.* brine.

H. V. Atwell. U.S.P. 2,006,010, 25.6.35. Dewaxing of lubricating oils by using monochlorodifluoromethane under pressure.

H. V. Atwell. U.S.P. 2,006,011, 25.6.35. Separation of wax from lubricating oils using propane.

E. R. Mitchell. U.S.P. 2,006,088, 25.6.35. Method of separating oil from fuller's earth using a solution of brine.

U. B. Bray. U.S.P. 2,006,092, 25.6.35. Production of lubricating oils from residual oil by treatment with propane and liquid sulphur dioxide.

U. B. Bray. U.S.P. 2,006,093–8 incl., 25.6.35. Production of lubricating oils from asphaltic crude oil by treatment with liquefied propane and furfural. W. S. E. C.

989. Patents on Fuel Oil. Bat. Petm. Mij. E.P. 428,972, 22.5.35.—Diesel fuels are improved by the addition of a small quantity of acetone peroxide.

E. I. Du Pont de Nemours. E.P. 429,763, 6.6.35. A fuel oil for compression ignition engines in which is dissolved a non-aromatic organic compound (1–5%) containing an oxime group (*e.g.* dimethylglyoxime). W. H. T.

990. Patents on Asphalt. M. Ernotte. E.P. 428,908, 21.5.35. Carbonating muds are used as dispersing and stabilizing media in the preparation of asphalt emulsions.

The muds are formed by the carbonating of saccharine juices and are mixed with soaps or resins.

"Traga." E.P. 429,107, 24.5.35. Apparatus for making mixtures of asphaltic substances and mineral matter.

Bat. Petm. Mij. E.P. 429,548, 31.5.35. Bituminous road oils are improved by the addition of 0·1–2% of solid high molecular, saponifiable organic acids (stearic acid, montan wax, solid resins, etc.).

J. C. Morrell. U.S.P. 2,004,210, 11.6.35. Asphalt is prepared from cracked residue by partial vaporization and the resulting residue heated in a circulation-zone until the desired type of asphalt is obtained.

J. V. E. Dickson. U.S.P. 2,005,077, 18.6.35. Production of pitch from coal tar by controlled pipe-still distillation yielding, in addition, the maximum quantity of oil.

S. P. Miller. U.S.P. 2,005,102, 18.6.35. Production of pitch from coal tar by bringing the latter into contact with hot coal distillation gases. W. H. T.

L. D'Antal. D.R.P. 607,770, 2.10.31. Bituminous materials are produced by heating phenol-containing tar, with vegetable fats, fatty oils, fatty acids, etc., and with sulphuric acid until a homogeneous material is obtained.

A. L. C. Halang. D.R.P. 609,008, 21.1.32. A road-surfacing material is produced by mixing asphalt or tar with liquid crude rubber, water glass and resin. The mixture is heated to about 180° C. if asphalt is used, and to about 120° C. if tar is used.

Straba Strassenbau Ges. D.R.P. 609,805, 6.1.33. Pulverous bituminous materials containing hydraulic binders are formed by simultaneously atomizing the binder and bitumen and adding to the binder a bituminous material of such fluidity that the grain size of the binder remains unchanged. L. S.

991. Patents on Shale. D. F. MacDonald. E.P. 428,990, 22.5.35. A mixture of oil-shale and coal is retorted, the hydrogen so produced being used to hydrogenate the oil-distillate. W. H. T.

992. Patents on Special Products. F. B. Dehn. E.P. 428,406, 13.5.35. A process for the preparation of methanol and formaldehyde from gas containing methane. The gas is mixed with oxygen or air and ignited in the cylinder of a partial combustion gas engine, the running conditions of which are such as to obviate complete combustion and formation of CO_2.

Kinetic Chemicals, Inc. E.P. 428,445, 7.5.35. An improved method of fluorinating acyclic hydrocarbons or their aryl derivatives by reaction with a hydrocarbon halide containing halogen other than fluorine, and hydrofluoric acid, in the presence of a catalyst (carbon).

Trinidad Leaseholds, Ltd. E.P. 428,542, 15.5.35. Insecticides or fungicides containing phenols and/or organic sulphur compounds (mercaptans) are derived from alkaline wash liquors which have been employed in the refining of petroleum, shale, lignite, oils, etc. W. H. T.

I.G. Farbenind. A.-G. D.R.P. 612,229, 19.10.27. Production of oxygen-containing organic compounds by catalytic reduction of CO with hydrogen at elevated temperatures and pressures. Carbonyl-forming iron is kept away from sensitive parts of the apparatus. L. S.

W. Mitchell and I.C.I. Ltd. E.P. 428,080, 7.5.35. Production of condensation products of acetylene by allowing acetylene to react with a glycol in the presence of acid-free freshly precipitated mercuric sulphate as a catalyst.

J. Van Baak and Bat. Petm. Mij. E.P. 428,949, 22.5.35. Powdered insecticides are prepared by subjecting tobacco to a dry distillation process and mixing the volatile distillation products before condensing with an adsorbent such as gypsum, lime, chalk, kaolin or talcum powder.

C. Lean. E.P. 429,185, 27.5.35. Preparation of insecticides from soaps of fatty acids obtained from petroleum hydrocarbons by contacting with oxygen in the presence of manganese oleate at 155° C. and under a pressure of 250 lb./sq. in. W. S. E. C.

Class 700. Utilization.

993. Automobile and Aero Engines. L. G. Callingham. *J.I.P.T.*, 1935, **21**, 464–476.—A concise account of the development during 1934 in the design of oil and petrol engines for road and aerial transport. G. R. N.

994. The Oil Engine. O. Thornycroft. *J.I.P.T.*, 1935, **21**, 477–490.—An account of progress during 1934 in the development of the oil engine for road vehicles, railway propulsion, aircraft, shipping and stationary power. G. R. N.

995. Engine Efficiency Improved by Higher Volatility. A. C. Foster. *Nat. Petr. News*, 8.5.35, **27** (19), 24D.—A number of relevant papers read at the annual meeting of the Natural Gasoline Association of America are reviewed. The papers, in the main, constitute a survey of the changes in the properties of gasoline in recent years and the effect of these changes on car performance. The examination of a large number of fuels shows that the average Reid Vapour pressure has increased by 0·5 lb., whilst in the A.S.T.M. distillation test the 10% point has been lowered by about 10° F., the 50% point by about 25° F., and the 90% point by about the same proportion. Concurrently with these changes engine efficiency has increased. Average top speeds have increased from 60 to 80 m.p.h., whilst at 50 m.p.h. consumption has decreased from 20 to 31 ton-miles per gallon. A reduction in the air-fuel intake temperature and in the fuel line temperature has made the use of these more volatile fuels possible and has eliminated, to a large extent, the troubles arising, in the past, from poor distribution. The need is stressed for a "volatility index," a means of reliably evaluating the volatility of a fuel. Some workers have adopted, and are satisfied with, the "Oberfell and Alden" number, which is the arithmetic difference between 284° F. and the 50% distillation temperature. Another system, devised by Rendall, is a chart correlating starting performance with the 20% and/or 70% distillation temperatures. The chart consists of three parallel scales, prepared and adjusted from actual performance data obtained by operating test cars on a series of fuels under widely differing cold weather conditions. H. G.

996. Gasoline Mileage and Maximum Power are Increased by Volatile Fuels. Anon. *Nat. Petr. News*, 8.5.35, **27** (19), 24A.—A comprehensive investigation of the effect on efficiency of the volatility of motor fuel has been carried on by means of controlled road tests with a standard car. Three fuels of approximately the same octane number, but exhibiting a wide range of volatility, have been used. It has been found that with constant carburettor and ignition adjustments acceleration increases with increasing volatility. The improvement in acceleration is greatest over the lower speeds. It was found necessary to make definite carburettor adjustments in the case of the more volatile fuels in order to obtain satisfactory mileage per gallon. With optimum carburation the loss in mileage was insignificant. Again, with the proper carburettor and ignition adjustments it was found that the maximum power output of the engine, as judged by the maximum speed obtainable, was considerably greater with the more volatile fuels. H. G.

997. Ease in Starting Petrol Engines from Cold. R. Barrington and J. L. Lutwyche. *J. Inst. Aut. Eng.*, 1935, **3** (8), 15–28.—Examination of temperature statistics in this country led the authors to adopt a standard temperature of — 1·0° C. for practically all the tests described. It was found that car temperatures attain the surrounding temperature in approx. 15 hrs. in still air, and the procedure adopted was to run the car on the road for a few miles, after which it remained in the cold room at — 1·0° C. for 18 hrs. before tests were made. The starter switch was then operated, and the speed measured at 3 sec. intervals by means of an integrating tachometer, simultaneous records being kept of current, battery and starter volts. The starter was then removed and coupled to a Prony brake and calibrated over the working range, from which the cranking torque of the engine was deduced. A table is given showing the speed required for starting and the crankshaft torque for various cars and oils, and it is shown that a torque of approximately 30·0 lb. ft. was required per 1000 c.c. capacity.

Figures are given analysing the cranking friction of a 10-H.P. car. These figures were obtained by gradual dismantling, and show that 42·7% of the friction was located in the piston and cylinders, and 54·5% in the crankshaft main bearings. The initial breakaway torque at — 1·0° C. was found to be usually about twice that required just to maintain motion. Curves are given showing static and moving friction against time in minutes after stopping, which show that these reach an ultimate value between 1 and 2 minutes after stopping.

Some attempt has been made to correlate cranking torque and oil viscosity, and from results obtained a table is given relating crankshaft torque with viscosity in centipoises at — 1·0° C., using new oils. It is pointed out, however, that small amounts of

dilution will in practice bring the figures for various oils much nearer together, and curves are given showing the effect of dilution on viscosity. 1% dilution is found to reduce the viscosity of an oil from 42% to 17½%, varying with its initial viscosity. Gear-box losses are dealt with, and curves are given showing torque against speed at various temperatures. The effect of the state of the battery is also discussed.

In conclusion, the authors comment on the trend towards lighter oils, and are of opinion that some indication should be given as to the viscosity of oils at temperatures between 20° F. and 70° F. The need for investigating the comparatively high cranking speeds required by British cars is also pointed out. C. H. S.

998. Petrol Injection Engine. G. L. Ensor. *J.I.A.E.*, 1935, **3**, No. 9, 13–16.—A short review of the possibilities of this system of operation. Assuming that the main problem of thorough mixing of fuel and air is successfully overcome, the author outlines the advantages, which are mainly as follows. Increase of power and economy due to absence of throttling and heavier charge weight possible owing to the fact that no preheat is required. Better scavenging is possible, as valve overlaps can be increased, resulting in larger weight of air available for burning. The possibilities of the two-stroke are also apparent, as good scavenging without fuel wastage should be possible, thus probably allowing the two-stroke to develop as much power as the four-stroke at half the latter's speed, whereby in some cases reduction gear for air screws might be eliminated. It should be possible to deal with heavier fuels, as carburation troubles would not arise, and freezing troubles would also be eliminated, thus lessening risk from frost and fire. C. H. S.

999. Progress Report of Volunteer Group for C.I. Fuel Research. T. B. Rendel. *J.S.A.E.*, 1935, **36**, 206–209.—Two test methods were proposed for evaluating diesel engine fuels some time before the formation of this group, viz. the critical compression ratio test and the ignition delay test. In the present report, the modified C.F.R. diesel equipment is described, and the programme is outlined, work on which, however, has not yet proceeded very far. At present, members are chiefly engaged in the investigation necessary for the perfection of the engine and technique, the main difficulty being to obtain steady injection. About ten of the new engines are now in operation. C. H. S.

1000. Rational Basis for Comparing Diesel Engine Performance. E. S. Dennison. *J.S.A.E.*, 1935, **36**, 210–214 and 236.—The author feels that, although such great divergencies exist between different types of diesel engine, it is nevertheless possible to put the performance of engines on a more uniform basis than is usually done at present. Diagrams for Otto and diesel cycles are given, showing characteristics of ideal cycles for these types which are obtained by using a "fuel mean pressure" which is proportional to useful heat input, and it is shown how actual performance can be similarly expressed. Correction for varying atmospheric conditions is also introduced, and it is shown that actual tests confirm the use of this correction. It is claimed that this method of analysis shows up defects in design, and valid comparison can be made of engines of varying types. Applied to a series of engines of various types the method of analysis shows great differences in comparative performance, and these results are discussed.

In conclusion, the authors claim that the system of analysis described permits of exact knowledge of any factor having influence on the combustion cycle, and should be useful for comparing competitive designs in similar fields. C. H. S.

1001. Trend of Motor Fuel Volatility is Still Upward in the Atlantic Coast Area. A. E. Becker, A. D. Bauer. *Nat. Petr. News*, 8.5.35, **27** (19), 30; *Oil & Gas J.*, 9.5.35, **33** (51), 65.—A number of tables, abstracted from records, give the properties of motor fuels marketed in four areas on the Atlantic Coast during the past six years. They show that there has been a steady increase in volatility over the range between 158° and 284° F. Smaller increases are noticeable below this range, whilst F.B.P.'s have remained practically constant. H. G.

1002. Heat Fundamentals Doom Alkyl-Gas as an Aid to Farmers. G. G. Brown. *Nat. Petr. News*, 15.5.35, **27** (20), 24A.—Arguments and data are presented which contend that an attempt to assist the farming industry by blending alcohol with gasoline is a project which is uneconomic and impractical, and doomed to failure under

any conditions likely to exist for many years. If a 10% alcohol/gasoline blend is used under the same engine conditions as a straight gasoline, fuel consumption is increased by about 5%. If the ignition is adjusted to take full advantage of the increased octane number of the blend, there may be a gain of some 3% in efficiency, which must, however, be offset by a loss of 5% due to the lower calorific value—a net loss of 2%. Apart from these considerations are those of the increased cost, the danger of separation by contamination with water, the increased liability to trouble from vapour lock, damage to lacquer finishes, and the more rapid deterioration of fuel pump diaphragms. The farming industry uses 23% of the gasoline used in America, and it is demonstrated that the income from the sale of cereals for alcohol manufacture would be more than balanced by the loss entailed by the increased cost of the blended gasoline, increased consumption, the cost of purchasing "distillers grain" for cattle feed, and ultimately the loss due to the decrease in revenue from royalties from oil leases largely held by the farming community. H. G.

1003. Motor Benzole. A. K. Steel. *J.I.P.T.*, 1935, **21**, 450–458.—Progress during 1934 in connection with this fuel is described under production of benzole by coal carbonization processes, recovery, refining, analysis and testing and its properties and use as a motor fuel. G. R. N.

1004. Liquefied Gas for Motors. W. Benninghoff. *Z. Ver. deut. Ing.*, 1935, **79**, 203.—Trials with butane and town gas were made without much difficulty, the town gas being stored at 200 atm. For a distance of 100 km. the quantity of butane consumed was 38 kg., and of town gas about 100 cu. metres. L. S.

1005. Liquefied Gas for Motors. Anon. *Chem. Fabr.*, 1935, 220.—The uses of (1) liquefied gases (butane, etc.), (2) high-pressure gases (methane, etc.), and (3) generator gases, are discussed. "Deurag" liquefied gas contains 60% propane and 40% butane, and has a lower calorific value of 20,000 k.-cal./cu.m. For a driving range of about 350 km. four bottles are sufficient. Two bottles of Ruhrgasol (1 kg. = 1·43 kg. benzine) each containing 45 kg. are enough for a driving range of 440 km. L. S.

1006. Bitumen Joint for Sewer Pipe. J. S. Crandell. *A.S.T.M. Proc.*, 1934, **34**, Part II, 581–590.—A brief account is given of an examination of the suitability of bitumen joint compounds for sewer pipe. Tests were made, using 6 in. vitrified clay sewer pipe, on a number of materials which included hot-poured types, cold plastic materials and compounds containing bitumen and rubber. The properties examined were: the ability of the joints to remain water-tight under pressure, resistance to flexure, the adhesive qualities of the compound, the effect of light petroleum and sewage, and the rate of settlement of mineral fillers in bitumens.

Details of the methods of test are given.

All the materials withstood internal and external pressure as encountered in ordinary sewers, materials containing 30–50% of filler were poured satisfactorily with water present in the trench, but asphalts containing little filler foamed excessively. The mineral in filled compounds was found to settle even in the containers at ordinary temperatures, and compounds containing more than 10% of filler showed a marked tendency for the filler to settle, thus causing the material to overheat, coke and burn. Petroleum ether caused failure of the asphalt jointing after several days, but in practice the amount of petroleum in sewage is slight, and no appreciable harm results. Coal-tar pitches are not affected by the constituents of sewage, but show a tendency to flow out of the joint. A satisfactory cold plastic compound was made from powdered asphalt flux and a solvent, whilst a poured bitumen–rubber compound was produced which was successful. A. O.

1007. Indentation of Asphalt Tile. J. W. McBurney. *A.S.T.M. Proc.*, 1934, **34**, Part II, 591–607.—This paper describes a portable instrument for measuring indentation of asphalt tile. Investigations made with the instrument show that the relationship between time and depth of indentation with a given load acting through a given sphere is expressed by $i = at^m$, i being the indentation in mils, t time in seconds and a and m constants, a being the indentation in mils in 1 second, whilst m measures the rate of increase in indentation with time. Values of m were found to vary from 0·10 to 0·30, but the upper limit for satisfactory service of a tile is 0·20. When the

load is varied on a given sphere, the relation between indentation and load is expressed by $i = Aw$, where w is the load and A a constant, while the relation between indentation and time is $i = bwt^m$, where t = time and b and m are constants, b appears to depend solely on the material, temperature and size of sphere, whilst m appears to depend solely on the material and temperature. A. O.

1008. Laboratory Service Test for Pavement Materials. A. T. Goldbeck, J. E. Gray and L. L. Ludlow, Junr. *A.S.T.M. Proc.*, 1934, **34**, Part II, 608–634.—Details are given of a circular track-testing apparatus designed for determining the relative stability of bituminous paving mixtures. The track is a concrete trough 14 ft. diam. at the centre, the trough being rectangular in cross-section, 18 in. wide and 6 in. deep. Provision is made for heating or cooling the track, and a 1-in. layer of insulating material placed under the track and on the sides reduces heat losses and dampens vibration. The track is equipped with a roller weighing 200 lb. per inch width, and is 6 in. wide, consisting of three cast-iron discs 2 in. wide, which revolve independently in order to reduce drag. The roller is driven by the rotation of a radial arm about a vertical axis at the centre of the track, and can be moved to cover practically the full width of the track while the machine is running. The speed can be varied from 0 to approximately 450 ft. per minute at the periphery of the track. In order to simulate traffic conditions, the roller assembly is replaced by a unit carrying a wheel fitted with a standard 7·00 by 20-in. pneumatic bus tyre inflated to 50–55 lb./sq. in., the unit being loaded to 1900 lb. by means of weights attached to the arm. Tests carried out with this apparatus included the determination of stability of aggregates under the action of the roller, a study of the effect of the percentage of bitumen and characteristics of aggregates on stability of road-mix surfaces, a study of the stabilizing effect of top dressings of screenings on open-type bituminous mixture, an investigation of the resistance to crushing under the roller and investigation of cold-lay liquefier type of bituminous mixtures. Full details regarding the materials used and results obtained are given. A. O.

1009. Protective Action of Bituminous Paints Against Corrosive Liquids. C. R. Platzmann. *Bitumen*, 1935, **5**, 61–62.—The quality of the paint is governed by the properties of the bitumen and by the amount and nature of the solvent used. High glaze on the finished coating is no criterion of good quality, as it is often not permanent. High-melting bitumen prepared, for example, by distillation under high vacuum, is less suitable than bitumen distilled under normal conditions or blown bitumen. The solvent used should be free from phenols and acid constituents. In a series of tests over some 2½ years, bitumen coatings were found to be resistant to 10% aqueous solutions of sodium and magnesium sulphates, but they were susceptible to the action of 0·5% aqueous sulphuric acid. C. C.

1010. The Effect of Heavy Oils and Greases on the Fatigue Strength of Steel Wire. R. Goodacre. *Engineering*, 1935, **139**, 457–458.—Twelve oils were examined on the Haigh–Robinson fatigue-testing machine. All the oils contained a bitumen base, and four of them contained fillers, two of which were of a fibrous nature. The lighter oils were applied by drip feed to a standard wire, whilst for the heavier oils and greases the wire was simply smeared with the substance. The effect of the oils and greases was to increase the limiting fatigue strength of the wire. They act, it is considered, by excluding oxygen which has been shown to be important in corrosion fatigue, and also by filling small surface markings, thereby minimizing concentration of stress. The fatigue properties improve with increasing viscosity of the oil up to a point, but then fall rapidly, then they become constant or fall slightly. The maximum fatigue strength is more marked with oils containing fillers, but it occurs at higher viscosity. The thicker oils cannot flow into the surface markings, whilst the fillers are considered to make up for the reduced efficiency of the thinner oils. A curve is given showing the relation between the log of the viscosity number and the limiting fatigue strength in tons per sq. cm. The viscosity number is the time in seconds to force 1 c.c. of oil through a hole 1·585 mm. in diameter under a constant load of 0·7 kgm./cm.^{2} at room temperature. The effect of the viscosity of the oil on polished wires was not so marked. Fillers apparently have no effect. For stresses above the limiting fatigue strength, oils were also beneficial both on polished wire and wire as drawn. J. L. T.

BOOK REVIEWS AND BOOKS RECEIVED.

Reviews.

ERDÖLMUTTERSUBSTANZ. BEITRÄGE ZU DIESER FRAGE. Von Dr. F. Hecht, Prof. Dr. K. Krejci-Graf, Prof. Dr. R. Potonié, Prof. Dr. H. Steinbrecher, Priv.-Doz. Dr. A. Treibs, Priv.-Doz. Dr. E. Wasmund, Dr. Dora Wolansky.

SCHRIFTEN AUS DEM GEBIET DER BRENNSTOFF-GEOLOGIE, HERAUSGEGEBEN. Von Prof. Dr. Otto Stutzer, 10. Heft. Pp. vi + 181. 1935, Verlag von Ferdinand, Stuttgart. Rm. 17.

DR. STUTZER has cast a wide net for the preparation of this new volume of his "Brennstoff-Geologie" series, and at first sight it might appear that he has caught some very strange fish. It is certainly a little startling, on turning the pages of a volume dealing with the original substances from which petroleum is derived, to find that the illustrations depict human corpses in various stages of disintegration, whales stranded on an Iceland beach, fragments of dog, duck and eel fished up from lake-bottoms, and the entire carcase of a mountain sheep, which emerged in 1933 from the ice of the Lyell Glacier, in the Yosemite National Park.

It is, however, the substance, and not the form of these occurrences, that interests the author of the first and longest essay in the volume, Dr. E. Wasmund, who is a limnologist, and has for some years been engaged in studying the conditions for the formation of *Leichenwachs* or adipocere, a substance which in the past has been a topic for forensic-medical rather than geological discussion. It is a brittle, waxy material, stable on exposure to air, and contains free fatty acids (chiefly palmitic and stearic), and their soaps (especially lime-, magnesia- and ammonia-soaps).

It is formed mainly by saponification of fats; but Wasmund believes that, in the presence of fats, albuminous substances may be broken up by anaërobic bacteria, with synthesis of fats and fatty acids. The essential factors in the environment which changes fatty and albuminous substances into adipocere are said to be: limitation (not necessarily complete absence) of oxygen supply; calcareous sediments; and alkaline waters. Wasmund argues that these conditions would be fulfilled in the environment regarded by many, if not most, geologists as most favourable for the generation of large quantities of petroleum—namely, in a semi-enclosed marine basin with limited bottom-circulation; and that the organic materials, chiefly fatty and albuminous plankton, accumulated in such a basin, would therefore change first into solid fatty acids of the nature of adipocere, and might persist in this metastable state through long epochs. This view, if it can be substantiated, will obviously be of very great value in elucidating the geological history of many oil-fields.

It is clear, however, that a great deal of work remains to be done before we can say with assurance what are the original substances from which petroleum was (and is) formed. Most of the essays in this volume approach the question in a very roundabout way; and it is therefore rather refreshing to find Treibs claiming to have proved with absolute certainty that chlorophyll-derivatives are present in a great variety of oils and bitumens, and that green plants must therefore have contributed some of the original material; hence that the temperature in the region of oil-generation could never have much exceeded 200° C.

To a large extent, the inconclusiveness of much of the skilled research work detailed in this volume is due to the rarity of the occurrence of oil-mother-substance in an easily accessible position. The world-wide investigation of marine muds by Trask and his collaborators failed to find any satisfactory source-rock. The search must be narrowed and deepened. The muds of the Black Sea appear to meet all theoretical requirements. There, if anywhere in the world, it should be possible to detect petroleum in the act of formation, or in a transitional-hibernating stage. B. K. N. WYLLIE.

WIE SETZEN WIR DIE VERLUSTE AN FLÜCHTIGEN LÖSUNGSMITTELN HERAB? Dr. E. Schwarz. Pp. 150. 1934. Berlin-Lichterfelde. Allgemeiner Industrie-Verlag G.m.b.H. Rm. 9.

In his preface to this acceptable little monograph on the prevention of losses of volatile solvents, Dr. Schwarz rightly directs attention to the importance of the subject in modern practice. It is not too much to say that success or failure in

limiting wastage of this kind may make or break a process or an enterprise, or even a whole industry. Recognition of this fact, elucidation of the scientific principles involved, and description of the methods available for aiding conservation represent the scope of the book.

The actual treatment is to devote some thirty pages to the physical and chemical properties of solvents and solutions—none too much when the range of properties is considered—and then in the rest of the General Part, which accounts for about two-thirds of the reading matter, to describe such procedure and methods as are applicable to all industries. The remainder, the Special Part, is given over to an account of individual processes. This portion is especially informative and interesting. Naturally most attention is paid to the ramifications of the cellulose ester industry, but rubber, resins and extraction processes are all gone into, and an appendix contains allusions to the winning of light liquid products from natural and refinery gases. Most of the practical hints in this latter direction are already dealt with in the General Part.

Reverting to the practical part of the general section, the subject-matter is divided between prevention of loss and methods of recovery. In both there is much excellent material, although more attention might have been paid to the important modern compression methods of recovery.

Altogether this is an attractive volume, although not particularly strong on the Petroleum side. It is clearly printed and illustrated, and likely to be of practical use to men in a diversity of industries. S. J. M. Auld.

Books Received.

Alberta. Annual Report of Department of Lands and Mines for Year Ended March 31st, 1934. Pp. 109. 1935, Edmonton, W. D. McLean.

The report of the Director of Petroleum and Natural Gas, which is included, occupies 17 pages, and contains a map of the oil and gas fields of Alberta and a generalized structure section from Turner Valley to Aldersyde. The report is mainly concerned with operations during the year ended March 31st, 1934, while an appendix discusses oil and gas potentialities of the Aldersyde area.

British Standards Institution: Handbook of Information. Pp. 120. 1935, London, B.S.I. 1*s*.

Detailed information is given concerning the activities of the B.S.I., together with an indexed list of British Standard Specifications as at July 1st, 1935. The new or revised specifications issued since January 1st, 1935, include Compressed Rock Asphalt, Rolled Asphalt, and Mastic Asphaltic Surfacing, while specifications are in course of preparation for White Spirit, Dean and Stark Receivers, Density Hydrometers, Distillation Apparatus, Ubbelohde Apparatus, Viscosity in Absolute Units, Cable-drilling Tool Joints, Casing, Tubing and Drill-pipe, Fuel Oils for Burners, Fuels for Heavy Oil Engines, Classification of Lubricating Oils, and Turbine Oils. The Annual Report of the Institution for 1934–35 is also included.

B.S.S. 618—1935. Emulsions of Road Tar and of Road Tar-Asphaltic Bitumen. Pp. 24. 1935, London, British Standards Institution. 2*s*. net. 2*s*. 2*d*. post free.

This specification, which covers emulsions for penetration (grouting and semi-grouting) and surface dressing, was originally prepared by the British Road Tar Association, and has now been approved by the B.S.I. and issued as a British Standard Specification.

Canada Department of Mines: The Canadian Mineral Industry in 1934. Pp. 119. 1935, Ottawa, J. O. Patenaude.

Details are given of the production, imports, exports, and prices of metals, minerals and fuels in Canada in 1934. The total production of natural gas was about 22,000,000 m. cu. ft., and of crude petroleum 1,417,368 barrels, an increase of 26% over 1933. The value of the crude petroleum was $3,558,482, which was 20% higher than the previous year.

INSTITUTION OF MECHANICAL ENGINEERS, PROCEEDINGS, Vol. 128. 1934. November-December. Pp. xi + 201.

This volume contains the following nine Papers: *High Pressure Plant for Experimental Hydrogenation Processes.* Barber and Taylor. An account of work carried out at the Fuel Research Station on the mechanical and metallurgical features of autoclaves, pipes and fittings used for an experimental hydrogenation plant. *Air Swirl in Oil Engines.* Alcock. An examination of the rotation of the air charge as an aid to fuel distribution in diesel engines. *A Survey of Ships and Engines.* L. St. L. Pendred. An historical survey of marine propulsion, including valuable notes on the development of oil tankers. *Heat Insulation as applied to Buildings and Structures.* E. A. Allcutt. *Design of Crane Hooks.* Gough, Cox and Sopwith. An account of mathematical and experimental investigations carried out at the N.P.L. in connection with the preparation of British Standard Specifications for lifting gear. *High Specific-Speed Water Turbines.* Fulton. *Yield of Steel Wire under Stresses of very Small Duration.* Prof. W. Mason. *Heat Convection from Parallel Vertical Plates in Air.* Carpenter and Wassell. *Failures of Chromium-Molybdenum Rolls.* Caswell.

INSTITUTUL NATIONAL ROMÂN. BULETINUL "I.R.E." Anul III.—No. 1. Pp. 240. 1935, Bucarest.

JAARBOLK VAN HET MIJNWEZEN IN NEDERLANDSCH-INDIË. TWEEDE GEDEELTE. Pp. iv + 201. 58 plates. 2 charts. 1935, Batavia, Landsdrukkerij.

This volume contains two reports of the Djambi Expedition of 1925, one on Geology by Dr. J. Zwierzycki and the other on Palæobotany by Prof. W. J. Jongmans and Prof. W. Gothan.

MARTIN, H. STANDARDIZATION OF PETROLEUM AND TAR OILS AND PREPARATIONS AS INSECTICIDES. Pp. 82. 1935, H. Martin, Long Ashton Research Station, Bristol. 2*s.* post free.

The growing use of hydrocarbon oils as insecticides makes it necessary that an attempt be made to specify the properties of such oils. Draft specifications are given for two grades of tar oils and three grades of petroleum oils. In use, preparations which only require mixing with water are needed and these are covered by four tar oil, four tar-petroleum oil, and nine petroleum oil preparations.

PRESTON, W. THE CORRELATION OF HYDROMETER SCALES. Chemical Engineering Group Data Sheet No. 10. Pp. 20. 1935, London, Chemical Engineering Group. 3*s.* 6*d.*

Complete conversion tables are given for sp. gr., Twaddell, Baumé, Brix and Beck scales, together with tables showing the relation between the Barkometer, Brix, Balling and Cartier scales and sp. gr.; the relation between the "New," Rational, Dutch and American Baumé scales; the various "proof" degrees (for alcohol) compared with sp. gr.; and the sp. gr. of sulphuric acid solutions.

The origin and peculiarities of each scale are dealt with and a complete list of conversion factors is provided.

SOCIÉTÉ D'ÉTUDES ET D'INFORMATIONS ÉCONOMIQUES: L'INDUSTRIE ET LE COMMERCE DES PÉTROLES EN FRANCE. H. Peyert. Pp. 78. 1934, Paris, 282, Boulevard St.-Germain. Fr. 7.50.

This publication was issued as a supplement to the Society's "Bulletin Quotidien" of June 1934 and discusses in some detail various aspects of the petroleum industry in France. The statistics given include figures for 1933.

TIRASPOLSKY, W. LE TRAITEMENT ACIDE ET L'EMPLOI DES PRODUITS CHIMIQUES DANS LES SONDAGES. Pp. 32. 1935, Paris, La Revue Petrolifere.

In dealing with the acid treatment of wells the author discusses the principle of the method and its limits of application, the action of solvents and chemicals on minerals and on deposits formed during drilling and production, the technique of acid treatment and the results obtained. A bibliography of 24 references and 9 patent specifications is appended.

UNITED STATES BUREAU OF MINES: CRUDE PETROLEUM AND PETROLEUM PRODUCTS. G. R. Hopkins and A. B. Coons. Pp. 82. 1935, Washington, Supt. of Documents. 10 cents.

NATURAL GAS. G. R. Hopkins and H. Backus. Pp. 15. 1935, Washington, Supt. of Documents. 5 cents.

NATURAL GASOLINE. G. R. Hopkins and E. M. Seeley. Pp. 12. 1935, Washington, Supt. of Documents. 5 cents.

The above are extracts from the Statistical Appendix to the Minerals Yearbook, 1934, and give statistical information regarding the production, imports, exports, etc., of the various products for the year 1933.

In 1933 the production of crude petroleum was 905,656,000 barrels, compared with 785,159,000 barrels in 1932. The production of natural gas showed little change, being 1,555,474 m. cu. ft. in 1933 and 1,555,990 m. cu. ft. in 1932. The output of natural gasoline dropped from 1,524,000,000 gallons in 1932 to 1,420,000,000 gallons in 1933, while the number of plants in operation decreased from 830 to 779.

UNITED STATES GEOLOGICAL SURVEY: BULLETIN 856. GEOLOGY OF BIG HORN COUNTRY AND THE CROW INDIAN RESERVATION, MONTANA. W. T. Thom, G. M. Hall, C. H. Wegemann and G. F. Moulton. Pp. vii + 200. 1935, Washington, Supt. of Documents. 60 cents.

This report contains information on the geology of the areas and their resources of water, coal, oil, and gas. Some natural gas was encountered near Hardin in 1915 and oil was struck on the Soap Creek dome in 1921. Additional wells have been drilled in the reservation but no production has been obtained other than at Soap Creek.

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Class 100. Geographic Occurrence.

1011. Petroleum Industry in France. N. Pervouchine. *Mon. Petr. Roum.*, 1935, **36**, 1015–1023, 1117–1123.—The year 1934 marked the turning point in the French petroleum industry, as more than half of the finished products consumed in the country were produced in French refineries. The latter represent capital to the value of 2000 million francs, and can process over five million tonnes of crude a year. Thus in 1933 total imports were 5,848,660 tonnes, of which 2,739,673 were crude, but in 1934 total imports reached 6,147,753 tonnes, of which crude accounted for 4,321,823 tonnes. Total refined products imported fell by approx. 40%. Tables indicate the total imports and the supply countries for the period 1927–1934. Crude has been supplied

mainly by the U.S.A., Venezuela, Peru, Iran, Dutch West Indies and Iraq, and the paper indicates which French refineries are processing these various crudes. Iraq crude is treated by several refineries. The crude receives a preliminary distillation to 140° C. under a pressure of 5 kilos./cm.², which removes H_2S, light fractions, etc. The light fronts are soda washed, mixed with heavier spirit, acid refined, washed and steam distilled, keeping the temperature below 177° C.; octane number about 50. Cracking and reforming are used to increase the octane number to about 67. A typical yield, including cracked spirit from distillation residue, is motor spirit 36%, kerosine 12%, gas oil 17%, fuel oil 19%, asphalt 13%, loss and gas 3%. Tables of statistics given include figures for refinery production 1933 and 1934, and exports 1927–1934, while the author estimates that the French have saved about 340 million francs in 1934 through refining products themselves. The article explains, at some length, the system of import licences issued by the French Government and analyses in detail the costs incurred in marketing petrol in Paris, with attention being given to the large number of small importers who cater only for this region of France. The cost of rail transport in France is discussed, and taxes and custom dues are detailed in full. Production figures for Pechelbronn (Alsace) are given for 1881 to 1934. In the latter year 78,079 tonnes of crude were produced. Similarly the production of benzole in France is reviewed and the necessary statistics are given for the period 1921–1933. Other figures given include capital invested in the various groups in the French petroleum industry, the dividends paid by these Companies in recent years, and the tonnage of the French Mercantile Marine in 1914 and 1918–1933. The article closes with some information concerning the alcohol situation in France. In relation to that quantity of alcohol taken from the beet industry, it is estimated that in 1935 it will cost the State about 450 million francs, since the State buys alcohol at a price much higher than it sells it to the petroleum industry. W. E. J. B.

1012. Petroleum in Jugoslavia. C. V. Marti. *Mon. Petr. Roum.*, 1935, **13**, 939–943.—The existence of three petroleum zones has been established in Jugoslavia. Drilling has been carried out spasmodically since 1860, but no economic production of petroleum has been found possible.

Wells situated at Perchetz produced gas containing about 40% methane, and a deeper well drilled at Bouiavitza and Lipika produced crude containing heavy motor spirit, kerosine, lubricating oil, asphalt, etc., but owing to the prior eruptions of gas under great pressure, conditions were not favourable for operation. Investigations showed that the formation is of the lower tertiary, with so-called domes extending over 10 km. The first of these domes was discovered after deep drilling at Bouiavitza; the work indicated that a series of productive beds, containing large quantities of gaseous products, occurring in horizontal plane should be found at a distance of 300–400 m. As a result, a factory was constructed here to produce carbon for electrodes. In other districts less satisfactory results were obtained owing to lower pressure of the gas. During recent years the State has carried out investigations in the district of Maievitza, first at Rojnija, where work was discontinued owing to the poor quality of the crude, and next at Zavida, where the geological situation is more favourable, but again work was suspended, in this case owing to financial difficulties. Owing to the crisis and the fiscal policy of the State, the consumption of petroleum in Jugoslavia is still reduced considering the number of inhabitants, the increasing development of industries consuming petroleum and the increase in the use of autobuses. The annual consumption of petroleum products is: motor spirit 30,000 tonnes, kerosine 40,000 tonnes, diesel oil 25,000 tonnes and lubricating oil 20,000 tonnes, part of which is produced by refineries in Jugoslavia and part imported, 85% of the imports being from Rumania. A. O.

1013. Petroleum in Morocco. M. Migaux. *Ann. des Comb. Liq.*, 1935, **10**, 403–436.—A very complete account of the search for oil in Morocco and the results obtained to date. W. E. J. B.

Class 200. Geology and Origin.

1014. Regional Investigations. Oklahoma and Kansas. T. C. Hiestand. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 948–970.—This paper deals with stratigraphical and structural interpretations coincident with paleogeography. These are discussed under

two main headings: (*a*) regional distribution of production and occurrence of oil-fields from pre-Mississippian strata, (*b*) occurrence and significance of surficial *en échelon* faults in Palæozoic rocks in Oklahoma and Kansas.

The pre-Mississippian formations in Oklahoma—which all appear to thin northward—are exposed in the southern and north-eastern districts. In N.E. Kansas, however, the post-Simpson formations thicken to the north in contrast to the relative constancy of the thickness of the rocks equivalent to the Arbuckle Limestone and Simpson Group. Correlations have consequently to be extended from well-sample data distances of several hundred miles in order to study the stratigraphy of the producing regions in the various horizons of these rocks. Well-data are therefore supplied and comments made on the pre-Mississippian. Brief descriptions are given of the other formations present, viz. Mississippian, Pennsylvanian, "Permian" and post-"Permian."

A number of structural maps are furnished as an aid to the interpretation of the tectonics of the region. Most of the folding resulting from pre-Mississippian rocks is proved to become more intense with depth, and probably originates from the Basement complex. Where the intensity of folding diminishes with depth, however, the relationship of movement with the complex is probably not very close. Such is the case in Central Oklahoma, where folding is associated with surficial *en échelon* faults. Chronologically, a relatively short time span occurred in the process of movement, post-dating the youngest beds so folded.

In Oklahoma and Kansas the regional eastward slope is of a post-Tertiary development, and although these records are obscure, the more recent structural movements are of real and undoubted importance to petroleum geology in these States.

G. S. S.

1015. Stratigraphy and Structure of Pennsylvanian and Permian Rocks in Salt Creek Area, Mosquito Range, Colorado. D. B. Gould. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 971–1009.—The area described extends south-eastward from Buffalo Peaks to four miles S.W. of Trout Creek Pass in Park and Chaffee counties (Colorado). Several stratigraphical units of the Pennsylvanian and Permian formations are mapped, and of them three are established as new members of the Maroon series: the Coffman Conglomerate (? Pennsylvanian age), the Chubb Siltstone and Pony Spring Siltstone (Permian).

The Coffman Conglomerate (interbedded with sandstones and shale) varies in thickness from 615 ft. to 1000 ft. and overlies unconformably the Weber(?) wherever contact is observed. The petrography is discussed, accompanied by photomicrographs.

The Chubb Siltstone consists of red to red-brown siltstone with shale and calcareous beds near the base and sandstones in the upper portion. It has a thickness of 1827 ft. in the type section, details of which are furnished; a petrographic description of the rocks is also given.

The Pony Spring Siltstone, with interbedded sandstone and shale, is nearly 6000 ft. thick. A detailed section, together with petrographic characteristics of the sediments, are also given and discussed.

There are three major tectonic features associated with these rocks, viz. the Trout Creek fault, the Trout Creek–Pony Spring syncline, and the Coffman Ridge anticline. Detailed accounts of these structures follow, accompanied by a map.

Finally, an interpretation of the Pennsylvanian and Permian history of the area is given from conclusions reached from the petrology and stratigraphy of its sediments.

G. S. S.

1016. Government Wells Structure is Developing into a Major Field. G. R. Pinkley. *Oil Weekly*, 24.6.35, **78** (2), 57–58.—The Government Wells structure, Duval County, is almost completely developed, but the discovery of new flank production—the Loma Novio field—raises the possibility of drilling 300 more wells. This appears to be another sand lens on the east flank of the present Government Wells field, which had only two productive sands. All three sands are in the Jackson formation.

The surface geology of the new field is little more helpful than that of the old. The Oakville sandstone (Miocene) forms the hills, and lies unconformably on the Gueydan (which outcrops in the old field). Whilst it is probable that the Loma Novio structure is reflected in the surface beds, little faith is placed in the surface structural picture.

Sections drawn across the old and new fields from the present evidence seem to show that production is from sand lenses on an anticlinal fold, with some faulting on the west

side of the structure which is probably due to readjustments following the folding. The Jackson–Mirando interval diminishes on the west, and would seem to indicate the presence of some structure during sedimentation. The Loma Novio production appears to be on terraces. G. D. H.

1017. Deep Sand Development in the Eastern Area—Geology. S. H. Cathcart. *Drilling and Production Practice*, 1934, A.P.I. 108.—The geology of Oriskany sand development in Pennsylvania is briefly summarized.

The stratigraphic position of the "deep" sands of the eastern region and their productivity are mentioned, and the status of recent developments in the Oriskany sand in Pennsylvania and New York is outlined. Prospects for future developments in the Oriskany of Pennsylvania are discussed from the standpoint of structure, regional favourability and known characteristics of the sand. W. W.

1018. Natural Gas Developments and Possibilities East of the Main Oil and Gas Fields of Appalachian Region. O. C. Postley. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 853–875.—Much interest is being aroused by the possibilities of the discovery of natural gas in commercial quantities in the area east of the main developed Appalachain oil- and gas-fields. Such possibilities are considered the more promising since the discovery in 1930 of gas in paying quantities in the Oriskany in Schuyler County, New York, Tioga County, Pennsylvania, and other regions.

Gas has been found in commercial amounts in the area which is east of the 63 or 65 carbon–ratio line, and which is usually regarded as the limit for the finding of oil in economic quantities.

Detailed accounts are given of the regions east of the main fields in which gas has been developed or prospecting carried out. In this connection a map is given showing the Appalachian oil- and gas-fields (with the carbon-ratio lines from about 60% to approximately 80% fixed carbon), and isocarb maps of Pennsylvania and Wise County, Virginia. G. S. S.

1019. Geology of Venezuelan Andes. R. Engleman. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 769–792.—Although the bulk of the mountain mass of the Venezuelan Andes is composed of Archæan and Palæozoic rocks, the Cretaceous occurs at and above 400 metres, and the Eocene in large areas in the south-western portion.

The Archæan consists of varied metamorphic rocks, chiefly as black argillaceous schists. This group—the Mucuchachi Series—is considered to be the Basement complex. Overlying it unconformably are sandy and mica schists ranging to argillaceous and quartzite schists. They are Lower Palæozoic in age, have a thickness of 3000 metres, and are termed the Bellavista Series. The Upper Palæozoic is represented by the Mucupati Series, and is assigned to the Devonian; they are unconformable over the above-mentioned formations and have a thickness of 1200 metres. Overlying these beds are the Palmarito Series of Carboniferous age; confirmed by the presence of *Fenestella*, *Productus*, some gastropods and small trilobites.

The most conspicuous members of the beds occurring between the Carboniferous and Cretaceous are dark red sandstones and conglomerates. They may be in part Jurassic or Triassic, although no fossils of any kind have been found in them.

The Cretaceous (taken from Liddle and Heberg's classification) is made up of the Barranquin Sandstone, Cogollo Limestone and the La Luna formation. These rocks, together with some of the Carboniferous representatives, are recorded and mapped in new areas by the author.

The Eocene sediments are mainly sandstones and are rarely fossiliferous; subdivisions have therefore been based on lithological characters and colour. In eastern Venezuela there is little to distinguish these sandstones from the basal Cretaceous, excepting their position with respect to the La Luna Formation and the Cogollo Limestone.

Structurally, the Andes region is a great geanticline, and sections are given in the paper which serve to indicate its main tectonic features.

Dealing with oil possibilities, the author remarks that seepages are abundant along the outcrop of the Cretaceous, especially in the La Luna formation. In the Maracaibo basin there is evidence that oil originates also in the Tertiary rocks, and such a possibility is not excluded from the Venezuelan Andes. The mountain fronts are ruled out for large production, but the S.W. part of the Venezuelan Andes has features

which seem favourable, although problems of transport and other difficulties have yet to be solved. G. S. S.

1020. Portuguese East Africa will have Deep Wildcat. *Oil Weekly*, 24.6.35, **78** (2), 36.—An 8000-ft. test is to be drilled on the Cheringoma plateau, which lies about midway between Beira and the Zambesi river, and about 60 miles from the coast. The area is believed to be underlain by a thick series of unmetamorphosed sediments, ranging in age from upper Carboniferous to Eocene. The Eocene and upper Cretaceous outcrop, and are partly marine. Seepages are known in the lower Mesozoic of Madagascar, and it is believed that equivalent beds underlie this part of Portuguese East Africa. The structure is a well-defined zone of strike faulting, bordered on the south-east by a gently dipping arcuate structure, and the closure is believed to be at least 200 ft.

It is also reported that tests are to be made near Inhambane, north-east of Lourenço Marques in the southern part of Portuguese East Africa, where seepages have been observed in shallow wells. G. D. H.

1021. Organic Content of Sediments. P. D. Trask and H. E. Hammer. *Drilling and Production Practice*, 1934, A.P.I. 117.—This paper presents a preliminary statement of the organic content of 120 formations, or parts of formations, based on more than 25,000 samples from oil-producing areas in California, Wyoming, Montana, Colorado, Kansas, Oklahoma, and Texas. Sediments, in general, contain little organic matter. The organic content of very few formations is more than 4% and the general average is about 1·5%. Many formations in which the organic content is comparatively high, i.e. more than 2%, are associated with oil horizons. This feature seems to indicate that richness in organic contents is a favourable indication of source beds. However, the content of organic matter is not an absolute index of source beds, as some rich sediments are not associated with oil horizons and some oil horizons are not associated with rich sediments. Evidently, other factors have to be considered. Some of the data that have been obtained seem to indicate that a comparatively high volatility or low degree of oxidation of the sediments may be favourable indications of source beds. W. W.

1022. Contamination of Cores. W. L. Horner. *Oil Weekly*, 1.7.35, **78** (3), 29.—It has been assumed that the penetration of drilling fluid into cored oil-sand is a serious matter on account of the washing away of the major portion of the content of a cored formation. This would result in a great error when estimating the amount of oil, gas and water left in the sand.

Tests carried out on a large number of core samples from sands which show no water in the production show large amounts of water to be present in the core.

The author carried out research to determine what portion of water found in a core could have been from the drilling fluid. He found that typical amounts of water contamination approximate 5% of the pore space of the rock. With mud-laden fluids the penetration was found to be uniform throughout the length of the core barrel and that samples removed from the pit were contaminated just as much as those from the core barrel which had been exposed to fluid action for some time after being cut out of the formation.

The method of carrying out the tests is given. L. V. W. C.

1023. Geophysical Operations Very Successful in San Joaquin Valley in Past Year. B. Mills. *Oil Weekly*, 8.7.35, **78** (4), 28–29.—Fifteen geophysical crews are working in the floor of the San Joaquin valley using reflection dip shooting, and obtaining remarkable accuracy, according to the points where checking with cores has been possible. With the rapid alternations of hard and soft beds and general lack of consolidation of the Californian marine Pliocene and upper Miocene, poor results are obtained. The lower Miocene and Oligocene have thicker and better cemented beds, and yield good results, whilst the Eocene and Cretaceous give the best results. (The first five formations have produced oil, but the sixth has so far given only gas.)

Greatest success is obtained where Eocene and/or Cretaceous are present, for anticlines in these usually extend upwards into the overlying beds; where the basement complex is faulted and oil collects against the faults; where the basement complex forms a ridge against which oil is trapped in the overlapping sediments.

The Sierra Nevada crust block is slowly tilting, the Sierra Nevada mountain range

rising and the western end below the San Joaquin and Sacramento valleys sinking and being covered by sediments which have a thickness of several miles on the western edge. The thin sediments in the eastern parts of the valleys are essentially unfolded and dip westward in a monocline. To the west folding increases with the thickness of the deposits, giving steep anticlines on the western margin, where oil was first discovered in this area, and where the anticlines project above the plain as hills. In the east the structures are buried, although some, such as Lost Hills, Buttonwillow and Semitropic, give a slight topographic expression. Oil migrating up dip towards the mountain range has been trapped against faults, as at Mount Poso, Round Mountain and Mountain View.

Geophysical operations are proving most valuable in the flat, faulted eastern half of the San Joaquin and Sacramento valleys, where surface evidence is poor. It is noteworthy that all the fields discovered by this means have been gas-fields, but this may be due to restricting work to the valley floor and avoiding the edges which are more difficult to work. G. D. H.

1024. Geological Factors in Oil Prospecting with Reference to Australia. D. Dale Condit. *Australian Geographer*, May, 1935, **2** (6).—It is generally agreed that the chemical alteration of organic remains entombed within marine sediments is responsible for the generation of petroleum. Therefore the search for new areas of petroleum production must necessarily be based on a search for marine sediments with a relatively large organic content with suitable structures. When these and other governing principles are applied to Australia, it is apparent that only a small portion of this country merits serious field investigation.

Since Pre-Cambrian times the western two-thirds of Australia has been comparatively stable. This is illustrated by the fact that in this area no igneous intrusion of note has taken place since that period. A belt 100–300 miles in width on the extreme east has a very different history. Here vulcanism was prevalent during Devonian to Tertiary times.

The main chances of commercial oil seem to lie in the basins of Palæozoic and Mesozoic marine sediments. The Desert Basin in Western Australia is considered by Clapp as an unlikely area, owing to the predominance of sandstones and the absence of suitable source rocks. Clapp also disposed of the North-West Basin for similar reasons, but recent investigations have thrown considerable doubt on his conclusions.

In the east there is a basin of Permo-Carboniferous strata which include alternating beds of sandstone, sandy shales and coal-measures. This series is some 11,000 ft. thick, and is underlain by the Star Sandstone which is thought to be of Lower Carboniferous age. In the Main Coal Basin of New South Wales similar conditions prevail except that the depth of the basin is calculated as 17,800 ft. In some of these basins, folding movements took place in late Palæozoic and Tertiary times. These movements are strongest in Eastern Queensland and gradually die out in New South Wales.

After reviewing the various theories regarding oil formation, migration and accumulation, the author concludes that the evidence is insufficient to come to any decision regarding the prospects of commercial oil in Australia until the present investigations are completed. J. A. G.

1025. Exploration for Oil Out in the Gulf is within Engineering Possibilities. L. N. Williams. *Oil & Gas J.*, 11.7.35, **34** (8), 42.—It is expected that a systematic exploration by geophysics for salt domes in the Gulf of Mexico will be launched shortly.

Refraction shooting is more advantageous for a general survey since more territory could be covered in much shorter time and at less cost. It is believed a strip of as much as 3 miles wide extending the entire length of the Louisiana and Texas coast line could be shot very easily and with small cost.

For preliminary shooting adjacent to the shore it would be possible to shoot from the shore to detectors set up on boats in the Gulf or the process reversed and shots be placed at points out in the Gulf with detectors set up on shore.

To pick up domes 5000 ft. and deeper at points between 2 and 3 miles off shore, shots would be placed along a line paralleling the shore between 6 and 8 miles out.

Buoys will be placed for marking the locations where shots will be placed.

It is possible to use deflected drilling so that the location may be made near the shore and the holes drilled to any desired location out in the Gulf.

The drilling of the wells would not be the most difficult problem. The maintenance of the completed well under control at all times, even when the connections are damaged by storm, is the serious problem. L. V. W. C.

1026. Electrical Logging. J. C. Karcher. *Oil Weekly*, 15.7.35, **78** (5), 86.—An electrical logging attachment for a rotary drilling rig has been developed as a result of a series of experiments. It may be assumed from these experiments that resistance in a subsurface formation may be due to any one of four causes, (1) to the presence of oil in a sand, (2) to the presence of gas in a sand, (3) to the presence of fresh-water in a sand and (4) to the fact that the formation itself may be a dry limestone, dolomite, anhydrite, etc.

The electrical arrangement is as follows. The drilling bit is insulated from the pipe by means of a tubular section of bakelite about 4 or 5 ft. long. An insulated conducted rod is mounted in each section of drill-pipe, and can make connection with the conducting rod in the adjacent section as the lengths of drill-pipe are joined together. An insulated slip ring, provided with a brush for making electrical connection between the conductor and a suitable record-ohmmeter, is placed between the top of the kelly and the water swivel. A connection to a battery is made from the slip ring, and then a line is carried to earth through electrodes placed usually in the slush pits.

The chart feed on the ohmmeter is geared to the hoisting drum of the rotary rig, permitting a feed of one half or one inch per 10 feet or any desired feed.

A series of charts are given showing the results of a series of tests. L. V. W. C.

Class 300. Development and Production.

1027. Deep Wells. P. Stein. *Oel and Kohle*, 1935, **11**, 467–471.—An account of the special problems met in the drilling of a number of the world's deepest wells (deeper than 3000 metres).

Particulars are given of casing of exceptional length. P. G. H.

1028. World's Deepest Test. B. G. Martin and B. Mills. *Oil Weekly*, 1.7.35, **78** (3), 32.—The new world's depth record of 12,786 ft. has been reached by Gulf Production Co.'s., J. I. McElroy, 103.

Approximately one year was taken in drilling from 8600 ft. to 1100 ft., and the greater part of this time was spent in drilling below 10,167 ft. Very hard formations necessitating constant changing of the bit were encountered at the great depths.

It is reported that the maximum deviation is about 3 deg., and thus the hole may be considered very straight.

Down to 3800 ft. the hole was never off vertical very much, and at 4300 ft. the deviation was 3 deg., but at 4600 ft. it was less than 1 deg. and at 6500 ft. still less than 1 deg. From 6500 to 7400 ft. the deviation gradually increased to 3 deg., and down to 9600 ft. it became less, until from the latter figure to 10,000 ft. the hole was vertical. After 10,000 ft. no readings were taken owing to certain difficulties.

Several new practices were developed, such as the method of catching cuttings or samples from the mud line.

Three casing strings were run. The 15½-in. surface string was cemented at 762 ft., the 10¾-in. casing was cemented at 4014 ft. and the record string of 7⅝-in. casing was cemented at 10,301 ft.

Mud pressures were carefully considered. The pressure at the surface was about 200 lb. and this gradually increased to 1700 lb. near the bottom.

A total of 965 bits and core heads were used in drilling the hole. L. V. W. C.

1029. History, Development and Application of the Full-Hole Tool Joint. F. C. Gignoux. *Drilling and Production Practice*, 1934, A.P.I. 149.—The author outlines briefly developments leading to the design of the modern full-hole tool joint, giving strength figures for both "regular" and "full-hole" A.P.I. tool joints. He concludes with a statement on the uses and advantages of the full-hole tool joint. W. W.

1030. Drilling Mud and Full-Hole Tool Joints. R. Silent. *Drilling and Production Practice*, 1934, A.P.I. 140.—The author discusses the composition and properties of drilling mud and the problems encountered in the circulation system, with special reference to frictional resistance of the drilling string—this including colloidal content

as affecting the viscosity and rate of shear; also their control—this affecting the debris-carrying capacity of the mud, and abrasion of pumps. W. W.

1031. Electric System Capacities. W. C. Lane. *Oil Weekly*, 15.7.35, **78** (5), 77.—The cost of generating electrical energy used for operating induction motors may be divided into two distinct major items, (1) power-producing current and (2) magnetizing current.

The effect of the magnetizing current on the capacity of a plant has been discussed in a previous article, in which it was shown that the proportion of the power-producing current to the electrical total of the magnetizing and power-producing currents is called the power factor.

A maximum power factor is advantageous, since it permits a maximum generator capacity. In order to obtain this maximum power factor, all motors should be loaded to their rated capacities. Where motors are lightly loaded, the power factor may be improved by lowering the voltage below normal.

There are two methods in common use for improving the power factor of a standard motor after it has once been installed on a load. The simplest is by connecting a static condenser or capacitor to the terminals of the motor.

Diagrams are given to show the manner of connecting the capacitor.

L. V. W. C.

1032. Recent Developments in Joint Designs of Tubular Goods. W. C. Shutts. *Drilling and Production Practice*, 1934, A.P.I. 132.—Considerable development is under way to increase joint strength in both casing and drill-pipe. It has been necessary to set casing with consistently lowering safety factors in both collapse and tensile strength of the joint due to increasing drilling depths. Common practice now is to use safety factors of 1¼ in collapse and 2½ in tensile strength of the joint. It is necessary to set casing with lower safety factors than the above for 10,000-ft. wells using present A.P.I. pipe. Several new type joints are now being used on casing to increase the joint efficiency and on drill-pipe to overcome the fatiguing action within the threaded joint; others are in the development stage. W. W.

1033. Uniform System to Determine Extent of Corrosion Losses is Necessary. O. A. Knight. *Oil & Gas J.*, 4.7.35, **34** (7), 39.—Corrosion losses may be classified as (1) destruction of equipment, (2) cost of repairs, (3) loss of production, (4) indirect increases in production cost, (5) water flooding of sands caused by corrosion puncture of casing letting in water and (6) accelerated production decline.

Various theories to explain corrosion have been put forward, and these include (*a*) acid theory, (*b*) film theory, (*c*) peroxide theory, (*d*) direct oxygen attack, (*e*) colloidal theory, (*f*) electrochemical theory, and (*g*) biological theories.

All these theories are reviewed. L. V. W. C.

1034. Blow-out Prevention and Control. W. V. Vietti and A. G. Levy. *Oil & Gas J.*, 6.6.35, **34** (3), 15.—The authors classify blow-outs as primary or secondary. A primary blow-out refers to the flow of mud in combination with water, oil or gas from a rotary drilled hole. A secondary blow-out refers to a wild well.

The principal known causes of a primary blow-out are: (1) uses of improper drilling fluid, (2) careless practices.

With a thorough knowledge of drilling fluids the prevention of a primary blow-out becomes a problem of application and careful practice. The various factors which should be considered are enumerated.

The prevention of secondary blow-outs resolves itself into the provision of some type of blow-out preventer or control, but even when one of these is fitted secondary blow-outs may occur. A list of the common failures in actual practice and a number of prevention rules are given. L. V. W. C.

1035. Changes in Hydrostatic Pressure Due to Withdrawing Drill-Pipe from the Hole. G. E. Cannon. *Drilling and Production Practice*, 1934, A.P.I. 42.—It has been observed that most blow-outs in rotary drilling occur when the drill-pipe is being withdrawn from the hole. This paper describes a series of tests which was conducted to determine the factors which affect the magnitude of the pressure drop which occurs when the drill-pipe is withdrawn from the hole.

The pressure changes were measured by means of a sub-surface pressure gauge, which was either attached to the bottom of the drill-pipe or allowed to remain at the bottom of the hole as the drill-pipe was withdrawn.

The relation of the pressure drop occurring when the drill-pipe is withdrawn to the viscosity, weight and gel strength of the mud was determined. The effect of changes in the rate of withdrawal, rate of drainage from the bit, depth, annular space, diameter of the drill collar and distance the drill-pipe is moved on the pressure drop were also determined.

In some cases pressure reductions of over 400 lb./sq. in. were observed, hence it is apparent that withdrawal of drill-pipe can frequently cause blow-outs. The danger can be reduced by proper treatment of the mud. The reduction in pressure which occurs is lower with muds of low gel strength. W. W.

1036. Pressure Completions of Wells in West Texas. E. V. Foran. *Drilling and Production Practice*, 1934, A.P.I. 48.—Deep wells (8800 ft.) in the Big Lake field are completed under flowing conditions, using water (not drilling mud) as the circulating medium. In order to prevent penetration of circulating water into the 1900 lb. gas pay (at 8200 ft.), the water is lightened with sufficient high-pressure gas (about 800 cu. ft./brl.) practically to equalize the formation pressure. This method involves the use of hydraulic rotary table and snubbers, flush-joint drill-pipe, automatic slips (which grip whenever the drill-pipe weight changes from positive to negative as during a blow-out), pressure-drilling head, pull-down yoke, a high-pressure water knock-out separator, 500 lb. permanent separators, etc. The formations encountered are described briefly, and the drilling method and equipment are described in detail.
W. W.

1037. Accident Prevention. C. L. Hightower. *Drilling and Production Practice*, 1934, A.P.I. 176.—Accidental injuries in producing operations constitute an unnecessary waste, and are an indication of inefficiencies in operating methods. The author recommends :—

(1) Preparation and adoption of state petroleum safety orders to compel the negligent operator to provide safe equipment and adopt safe operating methods. (2) Accident prevention be made a definite part of all operating programmes. (3) Closer attention to the selection of workers and the placing of applicants on jobs according to their qualifications. (4) Greater effort in instructing the new man concerning his work, his company and the industry. (5) Development of standard operating procedures to go along with A.P.I. equipment standards. (6) Continuous inspection of properties by interested and experienced workers. (7) Fire and accident-prevention protective equipment be provided and workers instructed in its care and use. W. W.

1038. East Texas Pumping Methods and Equipment. B. Mills. *Oil Weekly*, 15.7.35, **78** (5), 57.—Although the percentage of wells in the East Texas field on the pump is small, almost every type of pumping equipment is to be found in daily use. As many of the flowing wells are rated as very weak producers, these will be shortly placed on some type of mechanical lift.

The average fluid level for the field stands at about 100 ft. for each 33 lb. of bottom-hole pressure, but in the low-pressure areas with bottom-hole pressures as low as 800 lb., the fluid level stands at about 1200 ft. The lifting load is comparatively light.

Little consideration is given to future loads by many of the smaller operators, who are being influenced by price.

Only when trouble arises will most of the wells be placed on the pump, but serious thought is being given to pumping problems in sectors now showing low formation pressures.

A flexible programme is being carried out, and this has resulted in a great variety of pumping installations. L. V. W. C.

1039. Pumping Foundations. D. T. Ross. *Oil Weekly*, 15.7.35, **78** (5), 51.—Four items are of importance in the installation of any pumping equipment. These are : (1) bearing power of soil, (2) orientation of equipment, (3) weight of foundation, and (4) strength of foundation.

Owing to changes in soil conditions from location to location, no fixed sizes for foundations can be given.

For economical and safety reasons the orientation of equipment should be given consideration.

Correct proportioning of the mixture is highly important, and will be determined by the requirements of the foundations.

Strength of concrete can be obtained by correct mixing, and a 1 : 2 : 4 mix will be found to give an economical proportion as well as great strength. L. V. W. C.

1040. Reconditioning Wells. R. E. McClung and E. S. Post. *Oil Weekly*, 15.7.35, **78** (5), 80.—Reconditioning wells in the Refugio field has shown the importance of anticipating future problems in advance of the original drilling campaign.

The withdrawal of large volumes of oil has resulted in the dissipation of much of the energy and the intrusion of formation water.

Means have now to be found for working over dead wells and salvaging the greatest profit from each well.

Three means are available: (1) drilling deeper, (2) plug back to upper strata, or (3) re-complete at the present level, and these are dealt with in the article.

L. V. W. C.

1041. Acid Treatment of Michigan Oil Wells. K. A. Covell. *Drilling and Production Practice*, 1934, A.P.I. 56.—The use of acid to stimulate oil production from Michigan line wells has shown a need for a study of acid treatment involving an analysis of the formation to be treated, the selection of a suitable type and amounts of acid, the time of treatments with respect to date of well completion, and an economic analysis of the results. W. W.

1042. Oil Field Explosives—Their Characteristics and Use. P. F. Lewis. *Drilling and Production Practice*, 1934, A.P.I. 73.—The author describes different types and qualities of explosives used in oil-well shooting, describing the underground results—this followed by directions for determining size of the shot and for shooting, with a number of examples showing good and poor practices. W. W.

1043. Application of Thermodynamic Data to Production Problems. W. N. Lacey and B. H. Sage. *Drilling and Production Practice*, 1934, A.P.I. 89.—The thermodynamic properties of hydrocarbons being studied by A.P.I. Research Project 37 are outlined. The experimental methods used in their measurement are described in principle. Illustrative data are shown in graphical form. A number of applications of such information to the problems of petroleum production are suggested. W. W.

1044. New Discharge Valve of High-Pressure Type for Low-Pressure Use. N. Williams. *Oil & Gas J.*, 6.6.35, **34** (3), 13.—Pro-ration has resulted in insufficient fluid levels, in low-pressure type separators with the conventional double-seated valves, to prevent by-passing of free gas into the tanks. A loss of gas, a loss of pressure on the lease-gas system and an agitation in the tanks increasing evaporation losses result from this by-passing.

With high-pressure separators these troubles are not experienced.

A special valve similar to the high-pressure type, but made adaptable to the old low-pressure equipment, was developed.

This valve is not operated directly by the float, but by the opening of a pilot valve by gas pressure when the fluid level is lowered in the separator. When the level in the separator is raised, the float closes the pilot valve. The opening and closing of the pilot valve closes and opens the main valve. L. V. W. C.

1045. Well-Spacing Problem—Low Well Density Increases Ultimate Recovery. J. R. Suman. *Drilling and Production Practice*, 1934, A.P.I. 158.—It has long been assumed that, in the development of an oil-field, maximum ultimate recovery can be obtained with a maximum density of wells. The author states that, on the contrary, the greatest ultimate recovery results from relatively wide spacing of wells, because it permits the most efficient utilization of the reservoir energy in moving oil from the pore spaces into the well bore and up to the surface of the ground. In common producing practice, reservoir energy has often been carelessly and wastefully depleted long before the oil content of the reservoir was removed. In such cases the ultimate recovery has been pitifully low, and the oil still remaining in the reservoir, amounting to one-half or, in some cases, as high as 90% of the original content, can now be recovered only in negligibly small proportions.

The author cites cases where old abandoned fields have been repressured and have

produced a worthwhile additional volume of oil. Data are given on several representative fields showing the estimated recoverable reserve, the well density, the production rate, the total years of productive life, at the so-called "allowable" rate, at the maximum possible rate and at the most efficient rate of production. W. W.

1046. Recovery of Oil from Bituminous Sands in Northern Alberta. K. A. Clark. *Nat. Petr. News*, 3.7.35, **27** (27), 30.—The sands are found over an area of 1000 square miles in Northern Alberta along the Athabaska River, where they occur as outcrops in cliffs 100–200 ft. high. The recovery of the oil is a difficult matter and the subject of much investigation. Recovery is carried out on a semi-commercial scale, by the flotation method, which is the most promising tried so far. The sands are mined and agitated by a continuous process, with hot water when the bituminous material is recovered as a froth with air and water, being separated finally by suitable means. The flotation process is sensitive to the reaction of the water, and since the sands usually contain ferrous sulphate, sodium carbonate is added to the wash water to give the mix a slight alkaline reaction. Separation is poor in acid condition or in the presence of calcium and magnesium hydroxides. Bitumen so recovered has been used for bituminous gravel road construction, and for the manufacture of roofing mastic and bituminous paint. H. G.

Class 400. Transportation, Storage and Distribution.

1047. New Practices Used in Pipe Conditioning to Combat Corrosion. N. Williams. *Oil & Gas J.*, 20.6.35, **34** (5), 14.—Operating companies are devoting increasing attention to the proper protection of pipe-lines.

The Houston Pipe-Line Co. has established a special corrosion engineering department, and a number of new practices in pipe conditioning and coating have been tried out.

The Company has standardized on hot coatings, 165 deg. pitch enamel being used almost exclusively. Asphalt-coated pipe is wrapped with Kraft paper to protect the coating and to facilitate the operation of a holiday detector. L. V. W. C.

1048. Low Cost Pipe-Line Station Developed. W. T. Ziegenhain. *Oil & Gas J.*, 11.7.35, **34** (8), 25.—Where less than 15,000 brl. of oil are to be handled daily, the Standard Pipe-Line Co. has standardized on a semi-permanent type of station, the advantages of which are fully tabulated.

The station consists of three 50-h.p. type Buda motors, and one 100-h.p. Hercules motor, each connected to a Gaso reciprocating pump.

Field gas is used to drive the motors.

All the pumping and power equipment is left in the open, thus relieving the station of the cost of buildings, and, in addition, promoting safety for the operators. L. V. W. C.

1049. Improvements in Gas Transmission and Compression of Natural Gas. A. L. Forbes, Jr. *Oil & Gas J.*, 6.6.35, **34** (3), 35.—This article deals with the high-pressure natural gas transmission pipe-line system of the El Paso Natural Gas Co.

The source of supply of gas is from Lea County, New Mexico, and the gas contains approximately 300 grains of H_2S per 100 ft., and the cleaning of this gas furnishes the Company with most of its operating problems.

The sour gas is purified in two treating plants consisting of two sets of scrubbing towers.

Three years is the average life of the lines, but where heat is used instead of aeration to reactivate the soda ash solution used in the scrubbing towers no unusually rapid depreciation has been observed.

The measurement of the gas has produced problems, but these have been overcome to a great extent after numerous experiments.

The greatest problem in operating the compressor stations is in connection with the cooling water, as the main line runs through desert country.

Sand storms have caused dust-proof hoods to be used to cover the piston rods on each of the engines. L. V. W. C.

1050. Handling Gas at Kettleman Hills. J. C. Albright. *Refiner*, 1935, **14**, 333–337.—Two kinds of gas are available, white sand gas on the crest of the structure,

and black sand gas lower down. The temperature of the former is 135° F. and of the latter 150–160° C. To prevent condensation in the pipe-line the gas is transmitted as warm as possible. In spite of this precaution, during the winter approximately 20,000 gallons per day of drips are produced. The measures employed are described. B. C. A.

Class 500. Properties and Their Determination.

1051. Ostwald Pipette urged as a Standard for Viscosity Determination. C. W. McConnell, R. E. Dunham, J. S. Stewart. *Nat. Petr. News*, 19.6.35, **27** (25), 25.—This article is a reply to a suggestion advanced recently by H. G. Nevitt (cf. Abstr. No. 795 (1935)) in which the adoption of the Saybolt Viscometer, with four jets of sizes to cover the whole practical range of viscosities, as a standard instrument is urged. The authors cite many arguments against such an adoption, and make the alternative suggestion of the Ostwald Pipette. Their principal claims for the superiority of the latter instrument are: (1) that its calibration is based on the viscosity of water instead of an arbitrary oil; (2) greater accuracy and ease of manipulation. H. G.

1052. Composite Factor for Rating Lubricating Oil Greatly Needed. H. A. Everett. *Nat. Petr. News*, 19.6.35, **27** (25), 28.—It is suggested that valuable though the many tests applied to a lubricating oil may be for identifying it before use, all the properties alter considerably and quickly during the oils' use, and few, if any, serve to predict an oil's probable behaviour in use. Moreover, the properties of different oils alter differently when subjected to the same treatment in use. An investigation has been conducted in which each of four oils has been used in a battery of four identical automobile engines operating under carefully controlled conditions. The results of the determinations of the several properties of the oils before and after use are published in support of the points raised. It is therefore urged that there is urgent need of the standardization of some test or tests which will allow of the prediction of the extent to which the value of a particular oil will change in use. H. G.

1053. Measurement of Lubricity by the Thoma Oil Tester. E. H. Kadmer. *Oel and Kohle*, 1935, **11**, 434–437.—The Thoma machine consists essentially of two metal rollers contacting at right angles and driven electrically at 300 and 50 r.p.m., respectively. They are immersed in a bath of the test oil which is heated at constant temperature. The pressure of contact is standardized by means of a lever system. A torsion balance coupled with one of the rollers measures the friction (R), lubricity being expressed as $1/R$.

Results are given for a series of oils which show that the addition of 2% oleic acid to a mineral oil reduces friction to same extent as 5–6% rape oil. The superior lubricity of fatty oils compared with mineral oils is also demonstrated.

The effect of the nature of the contacting metal on lubricity of a given oil is examined for typical mineral and fatty oils by using white metals, bronzes and special alloys in turn for one of the rollers, the other being of steel. P. G. H.

1054. Mineral Oils. C. Leu. *Mon. Petr. Roum.*, 1935, **36**, 1131–1138.—This article is concerned mainly with a review of viscosity interconversions for the usual types of commercial instruments as well as the development of viscosity-index systems. A good bibliography is given and two charts for determining viscosity-index (Dean & Davis), one based on Saybolt seconds at 100° F. and 210° F., the other on kinematic viscosity at 50° C. and 100° C. W. E. J. B.

1055. Viscosity or Consistency. G. H. Klinkmann. *Asphalt u. Teer*, 1935, **26**, 530–532.—The Hoepfner–Metzger degree system is criticized, and it is pointed out that it is an arbitrary system based on arbitrary units such as consistency and dropping point, and therefore cannot be applied in the derivation of real units of viscosity. The author favours the use of absolute viscosity, defining this with the aid of examples. If these units are plotted on a log log scale, satisfactory linearity is obtained, and such graphs can be used for an accurate comparison of binding materials used in road construction, and for finding suitable working temperatures to ensure that the material is not overheated. The article concludes with examples illustrating the large errors resulting from the use of the H–M system. J. L. T.

1056. Action of High Temperatures on Mineral Oils. H. Weiss and A. Maillard. *Ann. des Comb. Liq.*, 1935, **10**, 437–454.—This article describes work on oils after use in a circuit-breaker, and deals with the development of a previous laboratory test and the establishment of a new one. The investigations on the oil from the circuit-breaker were confined to the amount and nature of the gas dissolved, the sludge, and the density and refractive index of the oil. It was found that the amount of gas dissolved increased with the number of breaks made in the circuit. Moreover, the gas quickly comes out of solution, a fact which has an important bearing on the presence of explosive mixtures above the oil in the circuit-breaker.

The oil itself was found to be practically unchanged after 16 breaks in the circuit. The gas evolved during make and break was also analysed and the figures together with tests on the oil and sludge are quoted. In one laboratory test a carbon filament immersed in the oil is raised to incandescence by an electric current. The density of the oil is not changed after an 8-hour test. A transformer oil, a white wax, castor and olive oils and a hydrogenated tar oil were investigated by this method. The hydrogenated tar oil gave most sludge on the filament, and least acetylene in the gas evolved, while the vegetable oils gave low sludge values, and emitted little gas. Water is, however, formed during their decomposition. The method is uncertain owing to lack of uniformity in the carbon filaments.

The other laboratory test is a so-called arc method. Two electric leads end in loops, through which pass a cross-wire also looped at the ends. Resistance at the points of contact generates heat which liberates gas. This lifts up the cross-wire and causes arcing. The sparks are, however, soon extinguished, and the process recurs. The wires soon get glued together by the sludge formed, but this trouble is overcome by mounting the support to the trembler of a buzzer. The amount of gas evolved increases as the temperature of the oil rises. Results by this method are very similar to those obtained in the carbon filament test, and the behaviour of the oil in both tests is practically the same as in a circuit-breaker. J. L. T.

1057. Thermal Properties of Hydrocarbons under Pressure. J. D. Lindsay and G. G. Brown. *Ind. Eng. Chem.*, 1935, **27**, 817.—The effect of pressure on the isothermal change in heat content (enthalpy) has been calculated from the equation of state suggested by Young, and has been found to agree with experimental data. The effect of pressure on the enthalpy of benzene has been experimentally determined from the Joule–Thomson coefficient, and used for the construction of an enthalpy–pressure–temperature chart. The enthalpy of pentane and benzene are compared on the basis of the increase in enthalpy per pound mol per $^\circ R$ at the same reduced temperature and over the same reduced pressure increment, and it is shown that this method successfully correlates the data. P. D.

1058. Estimation of Paraffin in Asphaltic Mineral Oils. A. Zwergal. *Oel and Kohle*, 1935, **11**, 431–433.—Fractions to 275° C. are first removed by distillation at atmospheric pressure. Distillation is then continued under high vacuum (below 1 mm.), a copper distilling flask being used in order to minimize condensation on its upper parts and consequent refluxing. The condenser is also of copper and is filled with warm water. Congelation of paraffin is thus prevented.

Paraffin is estimated in the distillate by precipitation with a mixture of chloroform and tricresol (50/50 by volume) at − 20° C. A correction is applied for the wax remaining in solution. This method gives somewhat lower results than when the asphalt is removed by refining without distillation. It is concluded, therefore, that paraffin is not formed by thermal decomposition of the original oil. P. G. H.

1059. Chlorination of Propane. I. The Homogeneous Reaction. S. Yuster and L. H. Reyerson. *J. Phys. Chem.*, 1935, **39** (6), 859.—The homogeneous reaction of propane with chlorine is shown to be of the chain type, as evidenced by an induction period, the inhibitory effect of oxygen and the fact that a packed chamber cuts down the extent of chlorination because of the decrease in the number of links in the chain. The mechanism is discussed and the conclusion reached that the complete picture is extremely complicated, and is an eight-stage process with an enormous number of combinations in the intermediate stages. In certain runs explosions took place with the deposition of carbon, but at no time were these strong enough to break the reaction chamber. At the higher rates of flow, the explosions occurred more frequently, but the use of high

partial pressures of propane appeared to eliminate this phenomenon. This would point to chlorine atoms as the initiators of the branching chains.

The type of reaction was shown to change with change in rate of flow. The reaction is treated mathematically and the values for E determined by use of the Arrhenius equation and also by the equation for the collision theory are 20,000 and 27,000 calories per mole of product, respectively.

High partial pressures of chlorine favoured the formation of the higher chloro-derivatives, whilst the use of high propane partial pressures gave a product in which the concentration of monochloropropane attained 75%, and under these conditions the actual conversion was between 80 and 90% of the chlorine input. E. N. H.

1060. Distribution of Aromatic Hydrocarbons in Rumanian Benzine. — von Cerchez. *Oel and Kohle*, 1935, **11**, 474–476.—In certain low-aromatic benzines the percentage of aromatics in several successive narrow fractions near 80° C. and 110° C., respectively, remained constant. In a high-aromatic benzine, however, the proportion increased regularly with the boiling point of the fractions. P. G. H.

1061. Synthesis of Alkylated Polycyclic Aromatic Hydrocarbons. M. Lerer. *Ann. des Comb. Liq.*, 1935, **10**, 455–464.—In the presence of an alkyl halide, sodium forms addition compounds with polycyclic aromatic hydrocarbons which normally do not give such compounds when dissolved in organic solvents. Thus, using *iso*butyl chloride and 2 : 3-dimethylnaphthalene, it was possible to prepare 2 : 3-dimethyl-1-*iso*butyl-1 : 4-dihydronaphthalene. This was a colourless liquid, boiling at 150° C. under 0·1 mm. pressure, d_4^{19} 0·9330, viscosity in poses at 20°, 30°, 51° and 65·6° C. was 0·599, 0·315, 0·124 and 0·066, respectively. Similarly for 1 : 4-di*iso*butyl-1 : 4-dihydrofluoranthrene, a viscous yellow-brown liquid, d_4^{19} 1·0182, viscosity at 40°, 50° and 64·5° C. was 9·06, 2·98 and 0·837 poises. Experimental details are given. W. E. J. B.

1062. Primary Decomposition of Hydrocarbon Vapours on Carbon Filaments. L. Belchetz and E. K. Rideal. *J.A.C.S.*, 1935, **57**, 1168–1174.—The authors review the theories advanced for the mechanisms of the decompositions of methane and ethane, when effected at different hot catalytic surfaces. Their own experimental work indicates that the primary decomposition of methane on carbon and platinum filaments at 1750 to 2000° K. takes place to yield methylene and hydrogen, *i.e.* $CH_4 \longrightarrow CH_2 + H_2$. The methylene radicals when condensing on a cooled surface readily react with one another to give ethylene. The energy of activation of the decomposition of methane on carbon was 95 kg.-cal./mole, whilst that for the decomposition of ethane to ethylene under the same conditions was 94·6 kg.-cal./mole. In the latter case no evidence was found for the formation of methyl or ethylidene radicals. W. E. J. B.

1063. Catalysts in the Hydrogenation of Carbon Monoxide at Atmospheric Pressure. J. Antheaume. *Ann. des Comb. Liq.*, 1935, **10**, 473–507.—The author has investigated catalytic activity and composition of iron–copper catalysts when used to hydrogenate carbon monoxide at atmospheric pressure and at 250° C. The main conclusions reached are: (1) that addition of potassium carbonate is not necessary to promote activity; (2) the copper plays a triple rôle, *i.e.* helps the low-temperature reduction of the ferric oxide, activates the catalyst and stabilizes it; (3) X-ray studies reveal that Fe_2O_3 and Fe_3O_4 are present, but not free iron. The Fe_3O_4 is possibly present in solid solution. W. E. J. B.

1064. Colour Measurement of Oils and Other Liquids. E. R. Bolton and K. A. Williams. *Analyst*, 1935, **60**, 447–453.—The colours of oils are measured by an instrument in which light from an electric lamp passes through a 1% copper sulphate solution to remove infra-red rays, and then through a Wratten filter before passing through a 1-in. cell containing the oil. Ultimately the light falls on a photo-electric cell connected to a galvanometer. A blank is performed with the oil cell empty, and the percentage of light transmitted is obtained by dividing the former reading by the blank and multiplying by 100. The operation is repeated with 6 filters covering the whole visible spectrum. It is essential to remove infra-red radiation, as these rays pass the filters and the photo-electric cell is very sensitive to them. The method has been tested for fatty oils, and it is found that the colours of oils of this class could be fixed by measuring the extinction or transmission of the red and green filters only. Figures obtained are roughly correlated with Lovibond units. C. C.

1065. Testing of Aircraft Fuels. M. S. Kuhring, *Engineering Journal Aeronautical Section Reprint*, No. 5, Feb. 1935, 16–23.—A description is given of the tests normally carried out in the laboratory on aircraft fuels, viz. colour, gum, oxygen bomb test, sulphur, vapour pressure, distillation range, freezing point, acid heat, specific gravity, acidity, and octane number. C. C.

1066. Gasolines should be Classified on the Basis of Volatility. A. L. Forster. *Nat. Petr. News*, 26.6.35, **27** (26), 81.—The article concerns a recent meeting of the Society of Automotive Engineers at which the volatility of gasoline and its relation to car performance were prominent. Recent investigations have shown that there is a direct relationship between manifold temperatures and rate of consumption of fuel. Similarly, the lower the manifold temperature, the higher is the permissible compression ratio, with its consequent increase in power output. Lower manifold temperatures call for higher volatilities, and fuel system design has been such as to allow of the use of higher volatility fuels. All these considerations indicate the prime importance of the volatility of gasoline, and the need for a volatility index was again stressed. No proposal was made for the adoption of a particular index. H. G.

1067. Estimation of the Water Content of Motor Fuels by Magnesium Nitride. L. Boisselet and — Rachkani. *Ann. des Comb. Liq.*, 1935, **10**, 449–454.—The method consists in heating the fuel (to which pure dry benzene has been added) with pure dry magnesium nitride, absorbing the ammonia evolved in standard acid and determining the excess acid. To ensure an excess nitride, about 5 gm. of the latter are added for each gm. of water present. The method is applicable to fuels containing ethyl alcohol, as the latter is without action on magnesium nitride. Methyl alcohol, however, reacts with the nitride, but it has been found that mixtures of methyl and ethyl alcohols containing less than 60% methyl alcohol do not react with magnesium nitride. Fuels containing a greater proportion than 60% must be diluted with ethyl alcohol. The method should be applicable to other petroleum products and to glycerine, higher alcohols, vegetable and animal oils. C. C.

1068. Behaviour of Motor Oils at Low Temperatures. A. Baader. *Oel and Kohle*, 1935, **11**, 471–474.—Consistency below the pour test, in conjunction with ordinary fluid viscosities at low temperatures, is stated to be of practical significance. A new method is described for measuring low-temperature consistency; the time is taken for a copper tube to be pulled out vertically from the chilled oil by a constant force applied by means of a weight and pulley arrangement.

Values obtained at − 35° C. showed no relationship either to pour test or to fluid viscosity curves down to − 5° C. P. G. H.

1069. Estimation of Ash in Used Lubricating Oils. F. Schmeling. *Oel and Kohle*, 1935, **11**, 433.—The largest particles of suspended matter are allowed to settle and are not included in the test sample; only finely-divided suspended particles are regarded as potentially harmful. During the combustion the crucible is covered with a sheet-iron cover pierced by a hole 1·5 cm. in diameter. Smoking is prevented if a bunsen flame is played on the burning oil vapour issuing from the opening. Wet oils are ashed thus: The oils is stirred with a folded ash-free filter paper moistened with absolute alcohol, and a little alcohol poured on the oil surface. The paper, which attracts water particles but not oil, is laid on the oil and is ignited at a turned-up corner. The oil then burns without splutter. P. G. H.

1070. Oil Volatility is Directly Related to Oil Consumption. L. L. Davis and R. D. Best. *Nat. Petr. News*, 26.6.35, **27** (26), 70.—A series of oils exhibiting a wide range of volatility, as judged by a distillation test carried out at 2 mm. pressure, have been used in controlled engine tests in order to record the rate of consumption. The engine was run at speeds equivalent to road speeds of 40, 50 and 60 m.p.h., other conditions being comparable with those obtaining on actual road vehicles at the time of test. The results indicate: (1) that the effect of volatility as compared to viscosity is greater than previously realized, particularly in cases of high-temperature operation where the basic consumption is low; (2) the effect of volatility on consumption is of minor importance when consumption is high because of an engine's design or on account of high running speed; (3) in a uniform series of oils from the same source there is a simple relationship

between front end volatility and consumption; (4) in an unrelated or non-uniform series of oils the volatility effect may be a function of the front end volatility modified by the over-all distillation characteristics.

These indications, it is claimed, are of importance in view of the present tendency to use lighter oils, and so upset the balance of production between neutral and bright stocks. H. G.

1071. Effect of Acidity in Olive Oils used as Lubricants. E. Peyrot. *Chimica e L'Industria*, 1935, **13**, 301–304.—The action of olive oils of acidity up to 8% has been investigated on copper, bronze, aluminium/copper alloys, steel and cast iron, by immersing weighed samples of metal in the oil for varying times at room temperature and at 100° C. When the acidity is about 1%, the action is negligible, except in the case of copper. With oils of high acidity (8%), copper is progressively attacked, forming a greenish-white gelatinous soap. Aluminium/copper alloys, as used for pistons, increase in weight in contact with acid oils even at room temperature, but the action is practically zero with pure aluminium and with aluminium/copper alloys containing 1·5% silicon. Both steel and cast iron are slightly attacked, the decrease in weight tending to reach a constant value. Bronze anti-friction metal is strongly attacked by the hot oil, but the reaction reaches a maximum after a time when no further loss in weight of the sample is recorded. C. C.

1072. Mechanical Testing of Road Asphalts. W. Bierhalter. *Bitumen*, 1935, **5**, 102–105, 128–132.—In this article the need for a laboratory method of evaluating road-surfacing materials is reiterated, since the usual physical tests do not fulfil this purpose, and in practice a long time must elapse before results are available. The theoretical principles underlying such mechanical testing are dealt with, particularly in respect of the difference in behaviour between cement and asphalt under varying rates of loading. The machines should be so constructed that the load is applied smoothly, preferably by a motor-driven spindle, whilst the speed of loading in mm./min. needs to be fixed.

Hydraulic machines suffer from the disadvantages of jerky motion, and loss of pressure through leaky joints. Experiences with compression, ductility, breaking, penetration and wear tests are detailed. The disadvantages of the German penetration test temperature of 22° C. are detailed, and the Danish method, which is considered superior, is quoted in full. As far as the sand-blast method of measuring wear is concerned, it is pointed out that the conditions do not remain constant during the test. It is recommended that comparative tests on preferably a standard glass surface be done at the same time. Typical machines are illustrated and described. J. L. T.

1073. "Chemoasphalts" and "Chemopitches." E. J. Fischer. *Teer u. Bitumen*, 1935, **33**, 251–255, 263–265.—These terms are applied to those asphaltic or pitch-like products obtained by chemical as distinct from physical processes. The initial material may consist of mineral oil or its distillates or residues, tars, resins, fatty oils or acids, waxes, etc. Among the treatments discussed are: precipitation processes using organic solvents, blowing with steam and/or oxygen-containing gases, treatment with sulphur or chlorine or their compounds, the action of mineral acids, metallic salts, *e.g.* aluminium chloride, etc. A brief review is given of the patent literature dealing with these processes. The products have in many cases only a limited application, but some of them find important uses in the paint and varnish industry, as electrical insulating materials in rubber mixtures, etc. C. C.

1074. Gas Conversion Factors. H. S. Nutting. *Ind. Eng. Chem.*, 1935, **27**, 820.—A chart is presented for determining the gas conversion factor for reducing the volume of a gas saturated with water vapour to standard conditions (dry. 0° C., 760 mm.). It is founded on the well-known equation

$$\text{Factor} = \frac{P - p}{760} \times \frac{273{\cdot}1}{273{\cdot}1 + t}$$

where P = total pressure
p = partial pressure of water vapour at t° C.

A table of conversion factors is also given, from which a chart may be constructed. P. D.

Class 600. Refining and Refineries.

1075. Modern Condensing Principles. B. T. du Pont. *Nat. Petr. News*, 5.6.35, **27** (23), 110.—The article sets out the advantages of the sectional condenser. These condensers, which can be cast in any metal, are usually of cast iron, and are made in interchangeable sections. They are self-supporting, and have internal ribs and "swirler" fins to promote rapid heat transference. In order to combat erosion, the walls are made thicker where this effect is greatest. The condensers are cooled by simple air circulation or by water sprays.

Economy of space and long life are the principal advantages claimed. H. G.

1076. Factors Affecting Entrainment in Bubble Cap Columns. W. T. Pyott, C. A. Jackson and R. L. Huntington. *Ind. Eng. Chem.*, 1935, **27**, 821.—A brief description is given of the column constructed for this work. The effect on entrainment of temperature, linear and mass velocity of the vapour, plate spacing and physical characteristics of the product have been investigated. The systems used were kerosine–air and water–air.

Increase in temperature in general produces an increased amount of entrainment. Entrainment may be decreased greater tray spacing, slower linear velocity of gas or lower rate of flow of circulated liquid. Equations of a general nature connecting these factors are proposed for use over a moderate range of the variables.

The impossibility of comparing the entrainment effects of the two liquids in question is discussed. P. D.

1077. Applications of Distillation in Modern Petroleum Refining. J. S. Carey. *Ind. Eng. Chem.*, 1935, **27**, 795.—The general features of units illustrative of present-day practice are outlined. Typical product analysis and tables of plant conditions and sizes are given. The types of plant discussed are crude stabilization; primary distillation in a single stage and in a two-stage atmospheric and vacuum unit; re-running of treated motor spirit; and re-running of lubricating oil stock. P. D.

1078. The Correlation of Octane Number and Cracking Time. S. D. Turner and E. J. Le Roi. *Nat. Petr. News*, 12.6.35, **27** (24), 30.—On the assumption that the rate of cracking in the reforming of naphtha is doubled for every rise of 25° F., a time/temperature curve may be derived from the actual amount of cracking as expressed in terms of equivalent seconds at 900° F.

The relation is expressed thus—

$$\ominus 900 = \int 2^{\frac{T+900}{25}} \mathrm{d}\ominus$$

where $\ominus$ and T are the co-ordinates of the time/temperature curve.

The correlation is given in a chart which serves to predict the time or change of time required to produce a gasoline of a given octane number. The exponential increase in reaction rate observed in most chemical reaction was applied to reforming, in the belief that although this is a complex change involving consecutive reactions, if the initial decomposition were the controlling reaction, equations set up considering it alone might predict the ultimate results obtained. The following analysis was therefore suggested.

Suppose all naphtha to consist of high and low octane number molecules H and L respectively, and that a naphtha of octane number N contained a fraction X of the L molecules, then

$$N = XL + (1 - X)H \text{ and } X = \frac{H - N}{H - L}$$

Assuming the reforming reaction to be from L to H and that it follows the first order equation $d \ln X = -Kd\ominus$, which gives on integration $\ln \frac{X}{X_0} = -K(\ominus - \ominus_0)$ or $\ln \frac{H - N}{H - N_0} = -K(\ominus - \ominus_0)$,

where $\ominus$ is the equivalent time of cracking corrected to some datum temperature.

The equation demands that a plot of log $(H - N)$ *vs* $\ominus$ be linear. By trial it was found that the data were linear if plotted in this manner with $H = 76$. If it is assumed

that the naphtha charged is changed to 76 octane number by a first-order reaction with a constant $K = -0{\cdot}0027$ when time is expressed in equivalent seconds at 900° F., all the experimental data can be predicted. The most serious objection is in setting 76 as the maximum value obtainable by reforming. If a higher number is assumed for H, only a slight curvature results, and it may be more satisfactory to say that the reaction approximates to a first-order reaction than to use the exact representation with 76. H. G.

1079. Knowles Oven Process. A. Fisher. *Gas J.*, 1935, **210**, 208–211.—The Knowles process implies the varied applications of the Knowles ovens, which consists of (1) direct coking of coals, (2) the processing of petroleum residues, (3) the manufacture of pitch-coke from tar or pitch, (4) preparation of high-grade metallurgical and domestic coke from non-coking coals by mixing with liquid hydrocarbons, (5) production of rich gas from unsaleable liquid products obtained in the coal and oil industries. The ovens are D-shaped, with a flat bottom heated from below. This means that the gas and vapours as released proceed vertically to a cooler zone, resulting in the progressive deposition and coking of the resinous matter present in the coal. The feature of progressive condensation and coking of resinous matter is conducive to the formation of good coke from semi-coking coals. Data are given dealing with costs, and the analyses of the various solid and liquid products are discussed. W. A. W.

1080. Removal of Carbon Disulphide from Benzoles "Methanol-Soda Process." W. H. Hoffert, G. Claxton and E. G. Hancock. *J.S.C.I.*, 1935, **54**, 239–246T.—As a result of modern practice in benzole recovery, increased amounts of carbon disulphide and thiophene derivatives are present in crude benzole, and it is therefore necessary to remove the CS_2 more completely to reduce the sulphur content to the desired figure. For this purpose chemical processes are preferable, and various processes are briefly surveyed, while processes depending on the removal of CS_2 as xanthate are discussed at length. Results of investigations into the effect of varying amounts and concentrations of different alcohols and alkalis, the effect of temperature and the influence of phenols are given. It is an economic advantage to use a fairly low ratio of alcohol to caustic soda, and taking costs, etc., into consideration, better results are obtained with methyl alcohol than with other alcohols. Lime and ammonia were found to be practically ineffective, and caustic potash, although effective, is more expensive than caustic soda. The decrease in CS_2 removed in a given time by definite amounts of reagents in the presence of water was roughly proportional to the quantity of water added. Large-scale experiments showed that methanol can be recovered at a concentration of at least 95%, and subsequent experiments were made with alcohol of this concentration. Increasing the quantity of caustic soda and the volume of methanol (separately) both increased the amount of CS_2 removed in a given time, but the effect in the former case diminishes fairly rapidly beyond a certain limiting amount. The removal is accelerated by rise in temperature over the range of 0–40° C. The presence of 0·3% phenols has little effect, but with 1% or more the removal of CS_2 is appreciably decreased. The sodium methylxanthate present in the aqueous solution obtained after treatment gradually decomposes on keeping, the rate of decomposition depending on the free alkali present and on the temperature, carbon disulphide, methanol, hydrogen sulphide, sodium sulphide and sodium carbonate have been identified in the products obtained on heating, even with small amounts of free alkali. On treating with acid so that considerable heat is evolved a gas with an odour similar to that of CS_2 is evolved, but which is insoluble in saturated caustic soda solution. This gas, however, dissolves on shaking with 10% caustic soda with formation of sodium sulphide and sodium carbonate, thus conforming with the properties of carbon oxysulphide. Decomposition of the sodium methylxanthate is avoided by distilling under reduced pressure. Reference is made to the potential uses of this compound. The authors attribute the decomposition of sodium methylxanthate with dilute sulphuric acid to the formation of methylxanthic acid, which decomposes rapidly into CS_2 and methanol. Suggestions regarding quantities of reagents and methods of procedure for treatment of benzoles and recovery of methanol and CS_2 on a works scale are made. Results of experiments are tabulated and a method is given for determination of CS_2, which consists in converting the latter into xanthate by means of a known quantity of caustic potash, oxidizing the xanthate with hydrogen peroxide and determining the excess of alkali. A. O.

1081. Ethylene Glycol Monoacetate as a Selective Solvent for Separation of Paraffins from other Oils. K. B. Edwards and R. Lacey. *J.S.C.I.*, 1935, **54**, 253–254T.—Aromatic and unsaturated hydrocarbons are soluble in ethylene glycol monoacetate, whereas paraffins are insoluble. Spindle oils gave the following percentage of insoluble products: Rumanian 87, Persian 91·5, Pennsylvanian 96, medicinal paraffin 100%. This solvent has been used to separate mixtures of anthracene oil and spindle oil. If the source of the latter is known, the results are quite accurate, since a correction can be applied for the solubility of the spindle oil. Similarly the proportion of kerosine in a mixture with creosote neutral oil can be determined. Since low-temperature carbonization tar oils contain paraffins, it is possible to detect these oils in admixture with high-temperature carbonization products. The solvent is particularly valuable for separating the paraffin constituents of the tar oils. Application of the specific gravity–boiling point curve method to the soluble portion (which is readily recovered on diluting the solvent with water) permits a reasonably accurate quantitative estimation of the relative proportions of high- and low-temperature tars in a mixture to be made. C. C.

1082. Packed Towers Useful in Solvent Refining. Special Uses of Propane. M. J. Livingstone and J. T. Dickinson. *Nat. Petr. News*, 3.7.35, **27** (27), 25.—The article deals primarily with the refining of Pennsylvanian lubricating oils. It appears to be necessary to improve the quality of these oils in order successfully to combat the competition of solvent refined oils from other sources, and the solvent process is stated to be the most promising means of achieving this improvement. The use of phenol in the single solvent extraction processes is discussed together with a brief description of the several types of washing plant. The claims of the packed tower are dealt with at some length, and the advantages of compactness, efficiency and flexibility emphasized. The article includes notes on the application of propane in this process and the possibilities that the versatility of this solvent opens up. In the temperature range of 100–212° F., and under its vapour pressure, propane shows the novel property that instead of behaving like an ordinary liquid and dissolving more of any partially soluble substance, it actually dissolves less. H. G.

1083. Kettleman Hills Natural Gasoline Plants. Anon. *Refiner*, 1935, **14**, 343–347.—Seven gasoline plants, all of the absorption type, are operated in Kettleman Hills North Dome, processing the wet gas from the field, in approximately equal volumes, at an absorption pressure of 450 lb., furnished by well pressure and booster stations.

The temperature of the gas averaging 135–165° F. necessitates gas cooling. Approximately 12,675,000,000 cu. ft. of gas were processed in January 1935, yielding an average of 1·2 gallons per 1000 cu. ft.

All gasoline manufactured in the field is stabilized to either 22, 24 or 26 lb. natural, with the overhead cut from the stabilizer being used in some cases to manufacture liquefied petroleum gases. B. C. A.

1084. Benzole Recovery. G. W. Page. *Gas World*, 1935, **103**, 49–51.—A description is given of a benzole-recovery plant at Montreal. Light oil is absorbed by wash oil in a series of scrubbers, the benzolized wash oil passing through vapour-to-oil heat exchangers to the wash oil still, where the oil is stripped of its light constituents by exhaust steam. The vapours pass through the heat exchangers and then to a reflux condenser, where intermediate light oil is condensed. Remaining vapour is condensed to form crude light oil. The latter is acid washed by the Ufer process and distilled, a weir box being used as reflux system in which the ratio of reflux to product made can be adjusted. The product may be deodorized by hypochlorite treatment. C. C.

1085. Riedel and Weber Adhesivity Test. H. Nussel and H. Neumann. *Bitumen*, 1935, **6**, 125–128.—The criticisms of various investigators regarding the Riedel method for examining the adhesivity of bituminous binders upon stone, and the claims by Riedel that the results obtained under the test conditions correlate with the results obtained in the water separation test DIN 1995 U.37 and with practice are examined. The behaviour of 12 samples of stone in the two tests was compared, and it is shown that results in some cases are in good agreement, whilst in other considerable differences were found. Two samples of Diabas which have given satisfactory results in practice

for many years were shown to be unsatisfactory in the Riedel test, whereas the test U.37 gave good results even though the bitumen was of an inferior quality. With a type of bitumen which has given satisfactory results in practice all of the samples of stone were satisfactory in U.37, while the Riedel test gave similar results to those obtained with the inferior bitumen. Investigations on three samples of stone with three bitumens of different softening point by means of the Riedel test show that, contrary to the statement by Riedel that different binders of the same type show slight differences in behaviour with a given stone, the best results were obtained with the bitumen having the highest softening point, and the worst results with the lowest softening point. Reference is made to the work carried out at the Dresden Institute showing the important relationship between the surface action of fillers and adhesivity. In conclusion, the authors are of the opinion that the Riedel test is of value as a research method, but that in view of the lack of knowledge regarding the subject and the many uncontrollable factors encountered in practice the test is not suitable for standardization. A. O.

1086. Patents on Refinery Plant. Electroflo Meters Co. E.P. 430,141, 13.6.35. An instrument for measuring the flow of liquids in open conduits, etc. W. H. T.

Drysdale & Co., Ltd., and W. Drysdale. E.P. 430,450, 19.6.35. Improvements in condensate extraction systems consisting of a pump fitted with a non-return discharge valve and for use at atmospheric or greater pressures.

E. W. Brocklebank and W. B. Mitford. E.P. 430,649, 24.6.35. Improved retort for use in distilling hydrocarbons in which the retort is provided with one or more longitudinal metal rollers fitted with spikes suitable for dislodging coherent coke from the walls of the retort.

C. S. Olfeuerungsgesell. E.P. 430,794, 25.6.35. Horizontal oil burner in which the oil is sprayed on to the cup from a stationary nozzle of which the apertures are inclined so that the oil impinges against the bottom of the cup.

S. Moore. E.P. 430,969, 27.6.35. Improved retort for distilling carbonaceous materials in which a combined distributing and levelling element is fitted to the retort inlet.

A. W. Syndergaard. E.P. 431,001, 28.6.35. An air-tight closed tank is described for storing liquids. The tank has metal walls and its top and sides are covered with concrete. Safety valves are fitted at the top of the retort so as to connect the interior with the atmosphere.

C. W. Stratford. E.P. 431,074, 1.7.35. A method and apparatus are described for heating and fractionating hydrocarbon oils.

Katadyn, A. G. E.P. 430,635, 21.6.35. Apparatus for the oligodynamic treatment of liquids by means of an electric current.

E. M. Dodds. E.P. 430,974, 27.6.35. Apparatus for indicating fluctuating fluid pressures in the cylinders of an internal-combustion engine consisting of a cathode ray oscillograph and a resistance element. W. S. E. C.

Refinery Engineers, Ltd. E.P. 431,486, 9.7.35. A process and apparatus for subjecting hydrocarbon liquids and gases to a combined fractionation and absorption treatment.

E. Wurbs. E.P. 431,641, 10.7.35. An anti-rust and rust removing composition, comprising, in addition to varnish and pigment, a material having an alkaline reaction, together with finely divided iron and lead, the latter constituting the galvanic element.

H. Skacel. E.P. 431,728, 15.7.35. A burner adapted to operate with heavy fuels and used in combination with ranges, stoves, etc.

J. Beresford, Ltd., and S. A. Smith. E.P. 431,736, 15.7.35. An improvement in centrifugal pumps to facilitate self-priming. It consists in the provision of a short conduit connecting the impeller chamber with the upper part of the pump. W. H. T.

1087. Patents on Cracking. Houdry Proc. Corpn. E.P. 430,174, and 430,312, 14.6.35. Improvements in apparatus for catalytic conversion of oils, leading to the more uniform control of operating temperatures of exothermic and endothermic reactions. A perforated fluid distributing or removing conduit is embedded in the contact mass together with heat-conducting means. In the second patent, the volume of the mass between the conduits and the wall of the reaction chamber is reduced in order to dispose the same quantity of contact mass about each of the conduits. W. H. T.

W. Lelgemann. E.P. 430,748, 19.6.35. Continuous heat-treatment of hydrocarbons in which 8 lb. of aluminium chloride and 100 lb. of stock are delivered at 250° F. to a reaction chamber; 2 parts of nitrosyl chloride to 100 parts of stock are then added to the chamber and the temperature is maintained between 250° and 700° F. Light constituents are meanwhile distilled.

W. Lelgemann. E.P. 430,813–14, 19.6.35. The former patent describes the use of ferric chloride as well as the compounds mentioned in the above patent; the latter makes use of calcium oxide instead of aluminium chloride.

C. W. Stratford. E.P. 431,107, 1.7.35. Liquid-phase heat-treatment of hydrocarbon oils. An internally heated shell is surrounded by an outer shell so as to leave an annular space between them, and a number of jets are arranged at different points along the outer shell. W. S. E. C.

1088. Patents on Hydrogenation. Int. Hydn. Pats. Co. E.P. 430,069, 12.6.35. A process for the destructive hydrogenation of distillable carbonaceous materials in which a separator is arranged behind the reaction vessel for the separation of vapours from liquid and possibly solid components. The walls of that part of the separator which is not filled with liquid are flushed with a liquid medium. W. H. T.

Chemical Reactions, Ltd., and J. Burns. E.P. 430,364, 18.6.34. Destructive hydrogenation of liquid carbonaceous materials by heating the material together with hydrogen up to the reaction temperature in a set of furnace tubes or pipe still. The products are then led to another similar set of furnace tubes in a separate compartment. Turbulent flow is maintained in both sets of tubes.

J. Y. Johnson. E.P. 430,655, 17.6.35. Hydrogenation of middle oils in the vapour phase to produce benzines. Preheated normally non-gaseous hydrocarbons boiling within the b.pt. range of middle oils and benzines are led to the reaction chamber near the inlet for the initial material. Products of desired b.-pt. curve can then be obtained. W. S. E. C.

I.G. Farbenind. A.-G. E.P. 431,519, 8.7.35. Hydrogenation of carbonaceous materials containing acid-reacting, corrosive components, in which an anti-corrosive agent is added to the material under treatment at the outlet of the products, or in the pipes leading to condensers and heat exchangers.

I.G. Farbenind. A.-G. E.P. 431,683, 9.7.35. Preparation of low boiling aromatic hydrocarbons by hydrogenation of coal tar fractions ("heavy benzene") by heat-treatment in the presence of hydrogen followed by catalytic destructive hydrogenation of the liquid products so produced at above 20 atm. pressure and at above 500° C. W. H. T.

1089. Patents on Gas. I.G. Farbenind. A.-G. E.P. 430,007, 4.6.35. Removal of ammonia and hydrogen sulphide, in which the former is first removed by means of sulphuric acid and the latter by a suitable scrubbing process. The spent scrubbing agent is regenerated, thereby producing hydrogen sulphide, sulphur dioxide or sulphur, and these materials are converted into sulphuric acid. The latter is then used for the removal of ammonia from the crude gas. W. H. T.

R. G. Bowman. E.P. 430,379, 18.6.35. Fine particles are separated from gases by treating with a washing liquid consisting of water and oil. The particles are then removed with the froth formed.

C. Otto and Comp. G.m.b.H. E.P. 430,865, 26.6.35. Sulphur is separated from gases containing hydrogen sulphide by washing the gases with a liquid, *e.g.* pyridine, quinoline, aniline, etc., containing sulphur dioxide. The organic bases are removed by treating the aqueous solution formed by the action of the hydrogen sulphide with a mineral acid, and then made alkaline by adding caustic soda or ammonia. The process can be carried out counter-current in two stages. Good crystalline sulphur is also produced.

W. C. Holmes & Co., Ltd., and D. M. Henshaw. E.P. 430,989, 27.6.35. Purification of combustible gases in which the wash oil with which the gases have been scrubbed is almost completely stripped and a proportion of the benzole recovered by stripping is revaporized into gas so scrubbed to enhance its calorific value. W. S. E. C.

1090. Patents on Lubricating Oil. I.G. Farbenind. A.-G. E.P. 430,080, 6.6.35. Solvent de-asphalting and extraction in which treatment is first carried out at a temperature at which, under the pressure employed, the solvent is present in the vaporized state. In the second phase, the solvent is employed in the liquid form. W. H. T.

Naam. Vencot. de Bat. Petr. Maat. E.P. 430,485, 19.6.35. Manufacture of lubricating oils with a low paraffin wax content by treatment with a diluent consisting of 50 parts of tetrahydronaphthalene and 50 parts of acetone.

C. C. Wakefield & Co., Ltd., and E. A. Evans. E.P. 431,066, 1.7.35. Addition of quantities up to 1% of tin and chromium oleates and up to 0·1% of tetraethyl lead to lubricating oils to prevent sludge formation. W. S. E. C.

Glidden Co. E.P. 431,508, 9.7.35. A lubricant comprising a hydrocarbon lubricating base and a chloro derivative of retene.

Bat. Petm. Mij. E.P. 431,609, 11.7.35. Preparation of lubricants by polymerization of unsaturated hydrocarbons obtained by cracking. The products of liquid-phase cracking (150–450° C. fraction) are refined by solvent extraction and cracked in the vapour phase, if necessary in the presence of catalysts. The final cracked product is polymerized by means of aluminium chloride. W. H. T.

1091. Patents on Asphalt. Soc. Res. et Perfect Ind. E.P. 430,061, 12.6.35. A road-surfacing material consisting of coal tar emulsion in which is incorporated a large proportion of powdered coal. W. H. T.

W. W. Groves. E.P. 430,917, 27.6.35. Manufacture of bituminous emulsions or dispersions containing insoluble humic acid by adding 2% of sodium chloride.

W. F. Rees and W. F. Rees, Ltd. E.P. 430,979, 28.6.35. Granular road materials are prepared from a matrix of soft bitumen heated to 210–250° F. to which a coarse aggregate heated to a temperature of 150° F. is added. W. S. E. C.

Soc. Res. et Perfect Ind. E.P. 431,474, 8.7.35. A road-surfacing material consisting of tar-bitumen or tar-pitch (65–85% of bitumen or pitch) and a carbonaceous filler (25–40%), the latter comprising pulverized coal.

R. O. Bratke. E.P. 431,642, 8.7.35. A process for emulsifying pitch, asphalt, etc., in which, during the initial mixing with water, about 0·01% of an aqueous alkali is added. The alkali solution contains very small quantities of aromatic hydrocarbon derivatives or their salts (*e.g.* benzoic acid, cresol, catechol, sodium salicylate). W. H. T.

1092. Patents on Special Products. Kerasin Ltd. E.P. 430,024, 12.6.35. A process for the production of mineral oil powders for use as disinfectants, germicides, insecticides, etc. Mineral oil, etc., is converted to a semi-liquid mass by treatment with soap powder and a mixture of beeswax and paraffin wax, after which suitable pulverulent substances (*e.g.* talc) are added.

British Thomson-Houston Co., Ltd. E.P. 430,298, 17.6.35. Production of a dielectric by polymerization of a halogenated olefin in contact with aluminium chloride. W. H. T.

Wingfoot Corpn. E.P. 430,335, 11.6.35. Preservation of anti-oxidants, *e.g.* for use in rubber, transformer oils, gasoline, etc., against deterioration on storage or in use by incorporating therein a compound of the formula $(A)N(R)X(B)$. A is an acyclic alkyl group substituted or unsubstituted, N is nitrogen or $=NH$ or $N-N=O$ group, R is aryl, aralkyl or substituted aryl or aralkyl groups, X is oxygen sulphur, selenium or tellurium. B is an alkyl, aryl, aralkyl or their substituted groups, R and/or B may represent phenyl or naphthyl radical. Examples are *p*-methylamino-*p*-aminodiphenyl ether, *p-iso*propylamino-*p*-aminodiphenyl ether.

R. Leigh. E.P. 430,620, 21.6.35. An insecticide for use to obviate the removal of wall plaster when carrying out dis-infestation of buildings, is prepared from 9 parts of petrol to 1 part of benzole to make 1 pint, 6 pints of paraffin and 1 pint of phenol.

F. B. Dehn. E.P. 430,664, 24.6.35. Bituminous lacquers or paints are prepared by compounding bituminous material with one or more cellulose derivatives and a solvent, *e.g.* esters of *cyclo*hexanol or its homologues or one or more ketones corresponding to *cyclo*hexanol or its homologues.

T. Neale. E.P. 430,773, 25.6.35. Preparation of plastic products from the product formed from a halide of a non-metal of the sulphur group excluding oxygen and an ethylene hydrocarbon or ethylene halogenated hydrocarbon compound. The combined halogen in the product is replaced by sulphur and/or selenium. W. S. E. C.

H. Hönel. E.P. 431,495, 9.7.35. Artificial resins are prepared by combining phthalic anhydride, glycerine and castor oil and heating at 260–270° C. until a product readily soluble in aromatic hydrocarbons is obtained. W. H. T.

1093. Patents on Coal. F. L. Dornbrook and M. K. Drewry. E.P. 430,587, 21.6.35. A process is described for powdering coal and like hydrocarbon fuel. The coal is first subjected to an oxidizing treatment, and then to a carbonizing action out of contact with the hot gas. Loss by agitation and dissociation of fine particles is thereby suspended.

H. P. Stephenson. E.P. 431,063, 1.7.35. Low-temperature carbonization of solid materials, *e.g.* coal, for the production of semi-coke. W. S. E. C.

Class 700. Utilization.

1094. Patents on Engines. J. Weidenoff. E.P. 430,388, 18.6.35. An interrupter tester for use with internal-combustion engines is described in which the indicating means consisting of two neon tubes is connected to one of the sets of breaker points. Each neon tube produces a bright arc while its breaker points are closed.

W. S. E. C.

1095. Butane Gas Successfully used as Engine Fuel. L. G. E. Bignell. *Oil & Gas J.*, 11.7.35, **34** (8), 31.—Butane has been successfully used in a deep well in the Mid Continent.

This butane is a by-product of casing-head gasoline, and is normally wasted into the tail gas from the plant.

The liquefied gas is stored in an 8000-gal. horizontal tank and every precaution is taken to reduce losses by painting the tank with aluminium and placing a roof on it.

Special fittings are necessary to permit the use of butane gas in internal-combustion engines under the conditions existing on a derrick. A complete description is given of the hook-up under the derrick floor. L. V. W. C.

1096. Blisters in Floated Asphalt. H. Kresse. *Asphalt u. Teer*, 1935, **35**, 612–613.—Blisters have been found in the case of floated asphalt on an iron surface. Analysis showed that a blister contained 21 c.c. of gas consisting of 20 c.c. of nitrogen and 1 c.c. of oxygen. On the assumption that 4 c.c. of oxygen have been chemically absorbed, the gas originally consisted of air. The conclusion is reached that the air is occluded in the asphalt during manufacture. Floated asphalt with high filler content and high bitumen tend to form blisters but with more than 30% of filler cracks in the coating are frequent. A sample of gas from a blister of floated asphalt on a pathway was found to contain 1–2% carbon dioxide. It is suggested that combustion of the bitumen by the oxygen of the air enclosed in the capillaries occurs on the finest particles of filler similar to the glowing of gas/air mixtures on spongy platinum. C. C.

1097. Waterproofing Corrugated Cardboard with Bitumen. F. Hoyer. *Asphalt u. Teer*, 1935, **35**, 591–592.—Hitherto full advantage has not been taken of the useful properties of asphaltic bitumen as an impregnating material for paper and cardboard. Mixtures with tar oils have been used, but the latter destroys many of the good properties of the bitumen. Although dipping processes are superior to surface coating, the use of straight bitumen presents difficulties here also. Asphalt emulsions are, however, particularly suitable for preparing bituminized products. In Holland, the emulsion is added to the pulverized paper pulp and the bitumen precipitated chemically. An intimate mixture is thus obtained, and drying at a fairly high temperature gives a fully impregnated product. In general 25–30% of asphalt is necessary to produce a completely waterproof product. Coloured products may be obtained by coating the bituminized product before completely drying with non-bituminous material. When prepared with a good adhesive surface, it is particularly suitable for manufacture of corrugated cardboard. C. C.

1098. Treatment of Paper and Cardboard with Asphalt Emulsions. F. Hoyer. *Asphalt u. Teer*, 1935, **35**, 613–614.—The advantages of asphalt emulsions for preparing bituminized paper and cardboard are further discussed (see Abstract No. 1097). The bitumen/pulp mixture can be formed into any desired shape by moulding, pressing, etc. A number of applications of the various products are described, including the following: as packing material, for paper sacks (for chemicals, cement, etc.), for insulating material and switch covers in the electrical industry, for containers for many products, for preparing corrugated cardboard and for general protection against moisture. C. C.

1099. Engine Oils and Aircraft Engine Performance. S. D. Heron. *J.S.A.E.*, 1935, **36**, 201–205.—Increase in oil viscosity can, it is claimed, permit an increase in the temperature of the oil entering the bearings. This relieves the oil coolers of a certain amount of work, so that they may be lighter and smaller, thus wind resistance is not increased and performance does not suffer. Moreover, oil consumption is reduced because less oil passes the piston rings. Service data on the relative stability of thicker oils are not available. Starting difficulty is not important, for the thicker oils would be used only in summer. Improvements in viscosity index would permit a reduction in the number of grades of oil necessary at present to suit varying climatic conditions; *e.g.* those encountered on flights from Canada to Mexico. Solvent refined products would be advantageous in such circumstances. The probable temperature cycle of the oil in its passage through the engine is considered, together with its bearing on oil consumption. The effect of oil stability is discussed both from the point of view of the action of the engine on the oil and also the action of the oil on the engine. Increase in oil viscosity due to distillation and polymerization is considered of minor importance provided the oil is changed at reasonably frequent intervals. In conclusion, the need for thorough correlation between laboratory engine testing, for which the claims of the single cylinder unit are put forward, and reliable chemical methods, with service data, is stressed. J. L. T.

1100. Lubrication Efficiency. Oil Consumption Controlled by Cylinder Design. M. O. Teetor. *Nat. Petr. News*, 26.6.35, **27** (26), 76.—It is pointed out that cylinder design can simplify or complicate efficient lubrication according as it is or is not well considered. For instance, a particular positioning of anchoring studs may produce such cylinder distortion under operating conditions as to render proper lubrication impossible. Similarly, the positioning of valves, combustion chamber shape and the size and disposition of water ways in the cooling system may be so arranged as to eliminate hot spots and uneven expansion, with their consequent dangers. Piston rings can only function in round, straight cylinders, and methods of producing such cylinders are mentioned. An investigation is described in which cylinder wall temperatures were determined by means of thermo-couples brazed into the cylinder walls. The significance of the findings is discussed. H. G.

1101. Bitumen in Cables. E. de Fano. *Bitumen*, 1935, **5**, 93–97.—Bitumen is eminently suitable for certain types of cable work on account of its ductility, low price and ability to penetrate fibrous materials. Under proper conditions of manufacture it can serve the dual purpose of insulating and weather-proofing. As an insulator it is suitable for lower electrical stresses, but power losses preclude its use for higher voltage cables.

Certain conductors are wound with cotton fabric impregnated with bitumen. The latter should have a dropping point between 70° and 110° C. Sometimes wax or ceresin is added, which lowers the dropping point but increases the penetrating power and adhesive ability, this last property, however, being undesirable. Where two coatings are applied, bitumen is used for impregnating and bitumen-wax mixtures for coating. The coated cable is passed through a water-bath to cool it, and then mechanically polished. Bitumen has an important application as a protective coating. In such cases it is usually applied over a rubber insulation for cables exposed to the weather, and it has advantages for this purpose over the varnish consisting of a mixture of red lead and linseed oil which is often used. In time the linseed oil becomes saponified to form a lead soap, and the coating becomes brittle, an objectionable feature from which bitumen is free. The latter is usually applied in the form of a solution. Mixed with gums, resins and drying oils, bitumen is also suitable for covering cotton-wound wire in motors and transformers. Up to 15% of a low-penetration bitumen can be added to rubber without impairing the elasticity. Aqueous emulsions of bitumen with rubber latex are now used.

Bitumen is superior to the distillation products of coal tar, anthracene and tar pitch because the latter tend to be fluid in summer and brittle in winter. Moreover, tar oil can be washed out with water, and phenols present form lead phenolates with the sheath. These are attacked by carbon dioxide to form lead carbonate while phenol is regenerated, a source of corrosion. In working, noxious oily vapours are given off from coal-tar products, whilst the tar also forms coke on the impregnating vessels, which has to be periodically removed. Bitumen, in some cases with added rosin, is also satisfactory for filling joint boxes and end caps. J. L. T.

BOOK REVIEW AND BOOKS RECEIVED.

Review.

OIL TANK STEAMERS AND MOTOR TANKERS. H. J. White. 5th Edn. viii + 277 pp. Glasgow. Brown Son and Ferguson. 1935. 15*s.* net.

"Oil Tank Steamers" has long enjoyed a unique reputation with the officers of tank vessels. The enlarged Fifth Edition, which has been published this year, will, no doubt, be welcomed by those officers who desire to keep abreast of the ever-changing conditions of all branches of the petroleum industry.

The first sixteen chapters of the work deal with types of tankers that are fast becoming obsolete, but they are of interest inasmuch as they outline the evolution of modern tanker construction.

The author describes the construction of tank vessels in use at the present time, and the reader can gain a good working knowledge of the vessels described. The diagrams are well carried out, clear and easily followed.

The chapters dealing with the carriage of petroleum and its products and molasses contain a great deal of matter of real value to the ship's officer.

The author deals successfully with a large number of subjects such as water ballast, tank cleaning, calibration, ullaging and sampling, calculation of quantities, flexible hoses, inflammable vapour, fire, dry docking, separators, stranding of vessels, lightering, pollution of water, submarine pipe-lines and jettisoning of cargo.

The subject matter contained in the chapter entitled "Different Kinds of Oil" is sufficiently accurate to enable the ship's officer to acquire an elementary knowledge of the various grades of oil described.

Most authors have experienced difficulty in successfully conveying technical matters to non-technical readers, and it would appear that Captain H. J. White, in the chapters dealing with Specific Gravity, Flash Point and Viscosity, has presented these matters intelligibly, but with some slight sacrifice of strict scientific accuracy.

The work contains many tables which may be of use to the ship's officer, but the author would have enhanced the value of the tables, contained in Chapter XLIII, if he had included degrees A.P.I.

A few small errors are noticed, but can be corrected in a subsequent edition. The coefficients of expansion given on page 174 do not appear to be those generally accepted. The photographs referred to in Chapter LVI do not appear in the reviewer's copy. On page 254 the factors given for inter-relation between Imperial Gallons, U.S. Gallons and Cubic Inches are in error, although on pages 228 and 229 the correct figures are quoted.

Considered as a whole, the work contains a great deal of valuable information which, if absorbed and practised by ships' officers, cannot fail to increase their efficiency.

W. F. JELFFS.

Books Received.

AMERICAN PETROLEUM INSTITUTION: PROCEEDINGS FIFTH MID-YEAR MEETING. SECTION III, REFINING. 165 pp. 1935, New York, A.P.I. 50 cents.

THE Fifth Mid-Year Meeting of the A.P.I. was held in Tulsa, Oklahoma, May 14–16, 1935. Section III of the Proceedings covers the Refining Division and contains papers and discussions on general refining subjects, with a special section on Progress in Solvent Refining.

ARGENTINA. UNIVERSIDAD NACIONAL DEL LITORAL. REVISTA DE LA FACULTAD DE QUIMICA INDUSTRIAL Y AGRICOLA. Vol. III. 1934.

Contains papers on "Estudio sobre la génesis del petroles," by G. A. Fester and J. Cruellas, "Un nuevo picnómetro," by G. A. Fester, and "Contribución a la teoria del cracking," by G. A. Fester.

BARBER, C. T. THE NATURAL GAS RESOURCES OF BURMA. Mem. Geol. Surv. India, Vol. LXVI, Pt. 1, 1935. 172 + xviii pp., Pl. 13. Rs. 6–8 or 10*s.* 6*d.*

The author states that the primary purpose of this work, which is divided into

fifteen chapters, is to direct attention to the vast natural gas resources of Burma. The first chapter discusses the Tertiary geology of Burma, and the next eleven chapters deal in detail with the occurrence of natural gas in various fields, as follows: Yenangyaung; Singu; Lanywa; Yenangyat and Sabe; Mimbu, Palanyon and Yethaya; other areas in Magwe and Myingyan districts; Indaw; other areas in Upper and Lower Chindwin districts; Thayetmyo; Prome, Henyada and Pegu districts; Arakan region. The last three chapters are respectively on the subjects of the composition of natural gas, the origin and accumulation of gas, and the conservation and utilization of natural gas. Two appendices are given, the first setting out the method of estimating gas reserves of the Pyaye field, and the second being a bibliography of 44 references relating to the Tertiary geology of Burma, 88 references in regard to the composition, origin and migration of oil and gas, and 71 to papers on the composition and utilization of gas.

British Standards Institution:

B.S.S. 619. Laboratory Incubation, Water Bath and Oven Thermometers. 9 pp. 1935, London, B.S.I. 2*s.* 0*d.* Post Free, 2*s.* 2*d.*

This specification provides a series of thermometers the scales of which can be read to about $\pm$ 0·1° C. with the naked eye. The temperature ranges (20° to 60° C., 30° to 75° C., 65° to 125° C., 115° to 180° C.) are suitable for most of the purposes for which these thermometers are required.

Hand, Robert F. Ocean Transportation of Petroleum in Bulk. 50 pp. 1935. North-East Coast Institution of Engineers and Shipbuilders, Newcastle-on-Tyne.

A paper read before the N.E. Coast Institution on April 5th, 1935, dealing with some of the economic and operating problems of ocean transport of petroleum in bulk. The discussion is included.

Ubbelohde, L. Zur Viskosimetrie. 42 pp. 1935, Verlag Mineralöl Forschung, Berlin. Rm. 9.50.

The temperature functions of viscosity is discussed, together with temperature-viscosity charts, and definitions are given for the terms viscosity pole and pole height. The Ubbelohde viscometer with suspended level is described in detail, and a table of equivalents of Engler, Saybolt, and Redwood viscosities and absolute viscosity in centistokes (1·00–1520) is appended.

ABSTRACTS.

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Class 100. Geographic Occurrence.

1102. Petroleum Situation in Ecuador and Prospects. G. Sheppard. *Petr. Times*, 1935, **34**, 223–224.—Near Quito seepages have been observed in fissures in a basaltic lava, and asphalt veins and other signs of oil have been widely noted. At present the oil produced is generally associated with the enormous thicknesses of shale which are interbedded with Tertiary sandstones and conglomerates. The nature and age of the source rocks in this region are controversial, for the oil is generally believed to have undergone regional migration, and whilst production is derived mainly from Tertiary beds, seepages are known in Cretaceous rocks. G. D. H.

1103. Nomenclature of Petroleum Products. Anon. *Mon. Petr. Roum.*, 1935, **36**, 1187–1189.—This article contains a table showing the classification and names of various petroleum products in Rumanian, German, English and Spanish. W. E. J. B.

Class 200. Geology and Origin.

1104. Geology of Texas Panhandle Oil and Gas Field. H. Rogatz. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 1089–1109.—Texas Panhandle oil and gas field (probably the most extensive field in the world) has an area of over 1800 sq. miles and a length of 120 miles.

Attention is mainly directed to those counties forming the four northernmost tiers in the Panhandle, and to the stratigraphy of the oil- and gas-bearing section, viz. the Permian strata below the Red Beds (Wichita–Albany series). These are divided into four zones in ascending order: E, "granite wash," D, dolomitic arkose, C, coarse white dolomite, B, brown dolomite, and A, anhydrite; the first four are oil and gas reservoirs. Details of these zones, with sections, are given.

Structurally, the Amarillo granite ridge forms the major feature of the Panhandle. It extends N.W. and S.E. for a distance of at least 110 miles, and from evidence available it appears to be an uplifted fault block with associated grabens or down-dropped fault blocks. Where faulting has occurred it seems to have been in *en échelon* form rather than as one extensive fault. These movements, which were progressive, probably followed along original lines of weakness and continued throughout the whole period of deposition.

Production is usually obtained where the position of the porous portions of the four zones ranges from 110 ft. above sea-level to nearly sea-level. The E zone is responsible for a large percentage of the production in the Panhandle, being most productive in the Gray County, where the zone is best developed. It contains most of the large wells (some with initial productions of 10,000–15,000 brls.), and is also a large gas reservoir. The C zone is the next important of these horizons, the average initial production of wells being about 250 brls. a day. Zones D and B are of much less value as oil producers, the latter being more important as a gas reservoir. Finally, the author discusses the possibilities of future production in other areas in the Panhandle.

G. S. S.

1105. Government Wells Oilfield, Duval County, Texas. J. Trenchard and J. B. Whisenant. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 1131–1147.—The Government Wells oilfield area is in the Laredo district, and situated in Duval Co., 30 miles W. of San Diego.

The surface rocks comprise the upper two members of the Catahoula Tuff of Miocene

age: the Middle (Soledad), consisting of sandstones and conglomerates with much volcanic material, and the uppermost member (Chusa) of tuffaceous clay.

For a depth of about 1600 ft. borings passed through the Gueydan (Miocene) and the Frio-Vicksburg (Oligocene). Between 1600 and 3000 ft. the Jackson was then encountered, followed by the Yegua beds with a thickness of 700 ft. and the Cook Mountain beds of approximately 1500 ft.

Structurally, the area as a whole represents a low gently folded anticline in the north, gradually merging into a monocline terminated by a cross fault in the south.

Accumulation of oil and gas appears to be due to a combination of folding, faulting and lenticular sands. A description of the drilling conditions and operating methods follows, together with a discussion on the ultimate recovery. G. S. S.

1106. South-west Texas District Enhanced by New Pools, Deeper Pays, Extensions. C. A. Warner. *Oil & Gas J.*, 29.8.35, **34** (15), 57–67.—Data in this paper are mainly compiled from reports of the U.S.G.S. and publications of the University of Texas.

This area is one of the largest single oil-producing regions in the U.S.A., covering about 64,000 sq. miles, and includes more than 136 oil and gas pools. The regional structure is monoclinal, the strata dipping from the Central Mineral Uplift towards the coast. The rate of dip is variable, ranging from 20 ft. per mile in the N.W. and increasing to 200 ft. or more in the neighbourhood of the Balcones Fault System. In the coastal region it rarely exceeds 15 ft. per mile at the surface, but increases with depth. Surface exposures become progressively younger from the extreme N.W. of the area towards the coast. The strike of the formations younger than the Fayette is roughly parallel to the coast, whereas in the formations older than the Fayette it gradually changes from N.E.–S.W. to W. and then southerly.

The main structural features are the Central Mineral Uplift and the Balcones Fault Zone. The latter has a displacement ranging from 500 to 1000 ft., and is generally downthrown to the S. and S.E. There is also a minor faulting zone which is thought to be an extension of the Mexia System, usually downthrown to the N.W. with much less displacement than the Balcones.

The area can be divided into three major productive districts: (1) Coastal, (2) Laredo-Pettus, and (3) Fault Line (Balcones). Widely diversified producing structures are encountered, including salt domes, faults, sand lenses and folding. The reservoir rocks are also varied, and include altered igneous rocks, Pennsylvanian and Cretaceous sands and limestones, Eocene, Oligocene and Miocene sands, and Salt Dome cap rocks. From the Fayette outcrop towards the coast there is a gradual thickening of the formations. The Oligocene, for example, increases from 900 to 3500 ft., and the Glen Rose from 500 to 3500 ft. This involves deeper drilling in order to reach the horizons which are productive up-dip.

A large map showing the productive areas with the structure accompanies the paper. J. A. G.

1107. West Texas Search for Ordovician Production shows Possibilities. G. A. Kroenlein. *Oil Weekly*, 22.7.35, **78** (6), 31–34.—The Ordovician of West Texas consists of the following: Ellenburger limestone (lower Ord.), which is porous in the upper part, and a prolific source of oil in the Big Lake field; the Simpson (middle Ord.), consisting of alternations of shales, sandstones and thin limestones; a cherty limestone (upper Ord.). The Simpson and the Ellenburger are the main prospects, and the absence of the former explains the poor results obtained by many Ordovician tests in North-central Texas and North-eastern Oklahoma. Some hope of production from the strata between the Permian and the Ordovician is held as a result of gas and oil shows.

The Big Lake field is the only producing area discovered during the past search in the Ordovician. The test well, in the centre of the shallow field, met the Ellenburger at 8500 ft. depth, and production is obtained from a porous, fractured dolomite. There are 1100 acres productive in the Ellenburger, and 2900 acres in the shallow Permian pay, which has a domal structure with 200 ft. of closure. The closure in the Ellenburger is considerably greater, and the north–south crest of the structure is half a mile east of the crest of the shallow Permian structure. No Simpson production has been developed, this formation being very thin or absent on the crest, and 350 ft. thick on the south-west flank.

Cranfell et al. George 1 test was drilled in a shallow producing field, and sub-

surface information shows an irregular nose with 300 ft. of Ellenburger, but no closure on the east. In Irion county three tests penetrated the Ellenburger, but were drilled in unfavourable positions. Two others were drilled on the strength of geophysical work, and all six passed from the Pennsylvanian, through a thin detrital zone, to the Ellenburger and found water.

Four tests drilled on the Ft. Stockton high in West Texas found no Simpson or Ellenburger, and entered pre-Cambrian granite. This, together with the trend of Permian and subsequent folds, seems to suggest a pre-Permian fault running N.N.W.–S.S.E.

The main production in Oklahoma is from the Ordovician, the Simpson being the most prolific due to the presence of a number of sand horizons. Production is obtained from major and minor folds, buried features (the Hunton arch with the Seminole group of fields), and mountain types of structure (Fitts pool with intense folding, overthrusting and faulting). In Oklahoma an area of shallow production on a subsurface high almost assures Ordovician production, but this is rarely the case in West Texas. G. D. H.

1108. Upper Permian Stratigraphy of West Texas Permian Basin. J. E. Adams. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 1010–1022.—Although data have been published on the Upper Permian stratigraphy of the Panhandle and the southern portion of the West Texas Permian Basin, no precise correlations between the two ends of the basin have hitherto been published. A description and interpretation of the stratigraphy of this intermediate area are here given.

The Upper Permian deposits in the Midland Basin have been divided into six series. These, when traced northward, proved that the Yates Sand is the southward continuation of the Quartermaster formation of the Texas Panhandle, and that the lower evaporates are equivalent to the Panhandle Whitehorse. Above the Yates, the formations are limited to the southern basin, and have no equivalents in the Oklahoma or Kansas Permian.

Accompanying the paper is a map giving the main structural divisions of the Basin with the approximate northern limits of the uppermost Permian formations, and a section across the map showing the stratigraphic relations of the Panhandle and S.W. Texas sections as determined by surface and sub-surface studies. G. S. S.

1109. Rodessa Discovery Reviving Activity in Louisiana and in Eastern Texas. N. Williams. *Oil & Gas J.*, 15.8.35, **34** (13), 10–12.—The Rodessa area is situated on the N.W. flank of the Sabine Uplift to the N.N.W. of the Red River Area. The discovery well is situated on the northern or upthrow side of a fault which strikes N.E.–S.W. Oil is found in the Glen Rose Series at an approximate depth of 6000 ft. Gas is also produced by a number of wells in an area which extends about 3 miles along the fault and for a distance of about 2 miles to the north. Production is definitely limited to the northern side of the fault.

The water table has not yet been determined, so that the lateral limits of oil and gas production cannot be estimated, but the Glen Rose Series here is very thick, and will permit of much deeper production.

The Glen Rose and Trinity formations are of Lower Cretaceous age and are divided as follows: at the base is the Lower Trinity Red Series, followed by Lower Glen Rose Lime and Sand Series (2000 ft.), Anhydrite Series (500 ft.), Upper Lime and Shale Series, capped by the Upper Trinity Red Series. The Lower Lime and Sand Series appear to be productive throughout. The Anhydrite has given production in certain cases where the rock is honeycombed, the oil having accumulated in cavities.

The area of maximum Glen Rose development is bounded by the Monroe fault on the east, the Mexia on the west, the Angelina-Caldwell Flexure on the south and extends northwards from the latter structure for about 150 miles. Providing the Glen Rose is within drilling depth, all this territory can be considered as a potential oil area. J. A. G.

1110. Geology and Economic Significance of Central Michigan Fields. B. B. Zavoico. *World Petr.*, 1935, **6**, 309–324.—The author deals particularly with the Greendale and Porter fields. He outlines their development and discusses drilling and production practices and the costs of such operations in the fields. The geology of the area is briefly described. The Greendale and Porter pools have an estimated ultimate

recovery of 53,000,000 brls., of which about 30,000,000 have so far been recovered. These fields have been important experimental grounds for two major well engineering advances in the past two years, the acid treatment of wells and pneumatic cylinder pumping. W. W.

1111. Rodessa's Possibilities. B. Mills. *Oil Weekly*, 26.8.35, **78** (11), 20–30.—Gas has been produced in this area for some time, but it was not until recently oil was discovered at 6048 ft. Both oil and gas are located on the northern, or upthrow, side of a fault which strikes N.E.–S.W. Production is from the Coquina Lst. of the Lower Glen Rose. This limestone has a porosity of 25%, and is expected to be the main producer if the field is proved to extend down dip.

The discovery well has given an average daily production of 6000 brls., and is believed to be on the edge of the gas–oil contact zone. If the field does extend northwards, larger wells may be anticipated. J. A. G.

1112. Hilbig Oilfield, Bastrop County, Texas. W. C. Blackburn. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 1023–1037.—The Hilbig Oilfield is situated about 10 miles S.W. of Bastrop. The surface rocks of the area consist of the Wilcox formation, and have a regional south-easterly dip. Borings show the Wilcox to have a thickness of 600–850 ft., followed by the Midway, 360–600 ft. Underlying the Midway, the Narvarro, Marlbrook, Pecan Gap, Taylor and Austin Chalk were all penetrated to a depth of approximately 1100–1500 ft. At the top of the Austin, serpentine occurred as an intrusion, and from this rock production is obtained.

The serpentine is laccolith in shape and approximately 5200 ft. in diameter. In the vicinity of the intrusion the Austin Chalk occurs as a truncated dome, although there is no evidence of this structure in any of the beds above it.

The serpentine, which is overlain by Taylor Marls, acts as the reservoir, the source beds of the oil itself probably being in the Taylor formation; no free gas is present in the reservoir. The oil obtained is green paraffin-base having a gravity of 35·5° A.P.I. A table is given showing the average hourly flow of initial 3-hour production tests, together with other well data. G. S. S.

1113. Wyoming Looks Better Due to Alteration made by Recent Important Sundance Formation Strikes. F. B. Taylor. *Oil Weekly*, 19.8.35, **78** (10), 30–32.—Tests in Southern and Eastern Wyoming have indicated possibilities of prolific production of oil and gas from the Sundance. This formation consists of four fine-grained sands with shale breaks. The Rohlf well gave 5000 brls./day from the third sand, and the Lamb 6 well obtained 4000 brls./day from the second and third sands. Three other wells have also obtained good production from the Sundance in this region.

On the Big Medicine Bow structure, Carbon county, a well found wet gas in the first Sundance sand at 5151–5222 ft., and oil in the second sand at 5299–5394 ft. In the Rock River field, 89 ft. of saturated Sundance sand were met at about 3060 ft., but there was insufficient gas pressure to cause flow. This field has produced 15,000,000 brls. from the Muddy, Dakota and Lakota horizons in 16 years. A test in the north-eastern gas area of Utah gave 32,000,000 c. ft. of wet gas in the Dakota at 5750 ft., but the first and second benches of the Sundance showed water. The Sundance gave a boom in the Salt Creek field in the early 'twenties. There it consists of three sands with a total thickness of 430–480 ft., the main production being from the two lower sands.

The Sundance has been proved in Colorado, but is lacking in the northern part of Wyoming, where most of the deep production, especially of the heavier oils, has come from the sands and limes below the red beds—Embar, Tensleep, Madison, etc. (all older than Sundance). Most of the fields producing black oil have penetrated the Sundance or failed to find it. G. D. H.

1114. New Coast Discoveries Throw Additional Light on Salt Dome Area as Future Reserve. B. Mills. *Oil Weekly*, 19.8.35, **78** (10), 19–23. The flat coastal strip, about 60 miles wide, extending from the Louisiana line on the east to Matagorda county on the south-west, is now a zone of great activity following the obtaining of production from depths considered excessive a few years ago, and also from questionable structures. Following the exhaustion of salt domes shown by surface evidence, geophysical work has been carried out, and its objective level increased from depths of 4000 ft. to 6000 ft. and more.

No new productive horizon has been found along the Texas Gulf coast since the Conroe field obtained oil from the Cockfield. However, this sand seems to thin towards the coast, and the evidence is such that it is not viewed favourably for extensive production on the coastal strip. Production from the Vicksburg formation at Pierce Junction gives the lower Oligocene a prominent position in many fields now producing from younger formations, and many believe that a large part of the reserves lies in these untested sands below the shallow producing sands round old salt domes.

The Anahua field in Chambers county has been extended almost 3 miles from the discovery well, and has the appearance of a low-lying anticline with sufficient closure to give blanket accumulation over a large area. The Dickinson field in Galveston county is a deep-seated salt dome, complicated by some faulting. Oil is obtained from the Frio of the Oligocene at a depth of about 8000 ft. The Hastings field produces from the Marginula–Frio section at 6000 ft., and one well showed 448 ft. of sand, the bulk of which was oil sand.

The most recent developments show oil accumulations on a few structures which barely "showed" during early geophysical work, and newer geophysical methods have caused a number of indicated structures to assume a more important position as prospects. The discovery of the Hastings field vindicates the theory that the deeper and flatter fields may largely replace the sharper types of domes which rise to levels near the surface. G. D. H.

1115. Edmond Pool Important. F. Swindell. *Oil Weekly*, 5.8.35, **78** (8), 46–50.—The Edmond pool lies in north-western Oklahoma county. The surface structure is shown by the outcrop of the Permian Garber sandstone and the overlying Hennesey shale. Some have described it as a closed anticline, others as a nose, or have failed to trace any structure, possibly due to sandstone members of the Hennesey which are easily confused with the Garber. The subsurface structure is generally believed to be a truncated, faulted anticline, resembling the Oklahoma City structure in many ways. The suspected fault is considered younger than that at Oklahoma City, and the throw is 350 ft., as compared with 2000 ft. The two faults seem to be aligned.

The geological section is similar to that of the Oklahoma City pool, with a break in the Wilcox sand, the upper part being of no commercial importance and of little or no value for purposes of correlation, since it is absent or badly eroded in places. The saturated thickness of Wilcox sand appears to be at least 175 ft., and an average production of 50,000 brls./acre is anticipated. G. D. H.

1116. Résumé of St. Peter Stratigraphy. F. C. Edson. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 1110–1130.—This paper is a brief résumé of a much longer communication given before the Geological Society of America (Dec. 1934).

For exact stratigraphical determinations, fossils occurring in the St. Peter sandstone series are considered to be of no value. Not until further and more detailed mapping has been done, and the same microscopic methods used as now applied to buried Ordovician rocks, will accurate correlations be possible between the surface and subsurface rocks connecting separate outcrops.

Tentative comparisons, however, are drawn by the author from work so far completed by other workers. Thus, it is possible that the St. Peter series will be found in Oklahoma to underlie beds of the same Black River age occurring in the Ozark region and Upper Mississippi Valley, and to overlie beds of known Chazyan age. Various correlation tables accompany the paper. G. S. S.

1117. Subsurface Data on Covington County, Mississippi. W. O. George and H. X. Bay. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 1148–1161.—By petrographic analysis and micro-palæontology the authors give the results of an examination of a number of cores and cuttings from Covington Co.

Formation contacts in certain places are indicated by distinctive heavy mineral assemblages where fossils are absent; some of these assemblages persist for a distance of 75 miles. The important mineral zones in the Miocene to the Cretaceous are tabulated.

Among the foraminifera recorded: *Elphidium sagra* is conspicuous of the marine phase of the Catahoula; *Asterigerina subacuta* of the Vicksburg Group; *Textularia hockleyensis* and *T. dibollensis* of the top and lower parts of the Jackson; *Ceratobulimina eximia* of the Lisbon; *Globorotalia wilcoxensis* of the Wilcox: *Ammobaculites*

midwayensis of the Midway; and *Ammodiscus incertus* etc. of the Eocene–Cretaceous transition beds. The discovery of deep-water foraminifera from these passage-sediments suggests that during this interim Covington county was not far from an area of continuous deposition. G. S. S.

1118. Petroleum Geology of Central Sedimentary Basin of Uruguay. V. Oppenheim. *Bull. Am. Assoc. Petr. Geol.*, 1935, **19**, 1205–1218.—The central and northern parts of Uruguay, consisting of Permo-Triassic Gondwana rocks, present a rolling topography with characteristics of a very mature peneplain. On its eastern and southern margins the sedimentary basin is sharply defined by the igneous rocks of the Basement Complex, and on the west by the basaltic traps of the Serra Geral. On the north the basin continues into Brazil. Descriptions of the stratigraphy of the area follow, accompanied by a table showing a correlation of the formations with South Brazil.

Evidence of an extensive inter-Gondwana erosional unconformity is observed over most of the basin. This is well exposed at the S.W. limits of the area where the Neo-Gondwana Tacuarembó and Triassic rocks of the Serra Geral overlap the lower Permian Bonito-Itararé with considerable stratigraphic break. Faulting is common in the region. In many areas where contact with the Basement Complex occurs, faults were observed, while the older Permian beds appear to be more disturbed than the Triassic rocks which cap them.

So far petroleum has not been found in Uruguay, and the possibility of accumulation of oil in commercial amount is considered unlikely. No active seepages and no showings of oil or gas were encountered in the many wells so far drilled. A table giving logs of the main test wells is furnished. G. S. S.

1119. The Oil Resources of the U.S.S.R. Prof. Gubkin. *Petr. Times*, 1935, **34**, 25.—It is believed that productive horizons lie below the overthrusts at Novo-Grozny and Stari-Grozny. There are indications that a continuous oil belt may run north-westerly from Maikop along the north-eastern slope of the Caucasus to Kutaissk, or even to the sea of Azov. In the Ural–Emba region new structures have been discovered at Iskineh and Koschagyl, and the salt tectonics are now known to extend from Emba far beyond the Volga to the west.

Oil has been discovered on the east side of Perm not far from Levshina, and more recently also a little west of Perm. Oil is reported in Siberia along the Tavda river, east of the Urals; at Surguta; in the north at the mouth of the Khatanga, and at Nordvik. Lower Cambrian bitumen has been found in the Lena–Olekmin region on the river Tolbe. The prospects in the Fergana lowlands are now viewed more favourably, and oil has been found in the west of Kazakstan on the borders of China. Indeed, Central Asia may be described as an immense petroliferous region. G. D. H.

1120. Origin of Oilfield Waters. N. Tageewa. *Petr. Zeit.*, 7.8.35, **31** (32), 15–23.—Geochemical investigations of oilfield waters show that most petroleum layers of the earth are combined near the surface and the petroleum belongs to the complex of that geological formation which is in continuation with the hydrosphere. It is important in studying new petroleum waters to examine: (1) the primary petroleum water, (2) the geological strata of the petroleum and of the petroleum water as to the probability of isolated strata, (3) the faces of the oil-bearing strata as to the geographical conditions of its formation, (4) the geochemical significance of the constituents, *e.g.* Li, Sr, Ba, B, Br_2 and I_2. W. S. E. C.

1121. New Applied Geophysics. A. Belluigi. *Oil Weekly*, 12.8.35, **78** (9), 47.—The author discusses briefly the various dynamical physical methods which have been used by prospectors for the direct detection of useful minerals underground, including petroleum. L. V. W. C.

Class 300. Development and Production.

1122. Mt. Poso Oilfield. A. Diepenbrock. Sum. of Operations, Calif. *Oil Fields*, 4th Quarter, **19** (2), 5–35.—Mt. Poso Oilfield lies on the east side of the San Joaquin Valley, north-east of Bakersfield in Kern County, and this report covers the early development of the field, deep sand discovery, fault and edge drilling. Stratigraphy, structure and subsurface conditions of the field are also reviewed.

Drilling and production methods are outlined and production figures are given.

With very few exceptions, most of the wells have been drilled with light rotary tools, chiefly of the semi-portable type, often with draw-works and engine or motor mounted on wheels. Electric-motor-driven rigs are most common, and one company uses petrol motors to drive the hoist and pump. The most common bit in use is the fish-tail—no hard rock bits are required.

Mt. Poso area is unique in that only three wells have failed to obtain a water shut-off, and these failures were due to faulty circulation while cementing the casing. The ease with which a primary water shut-off is effected is due to the character of the upper formations. All the wells are shallow, and were completed as pumpers. W. W.

1123. Roanoke Deep Tests. C. Leyendecker. *Oil Weekly*, 26.8.35, **78** (11), 36.—Two 10,000-ft tests are being drilled simultaneously in the Roanoke field in the Gulf Coast district. These two tests are being drilled with standard rotary equipment, and no planned deep exploratory programme had been made in either case.

Several plugging back and side tracking jobs were necessary in Jarnigan No. 1. The surface pipe in this well is 20-in. welded casing, which was set at 64 ft. A string of 13¾-in. casing was set and cemented at 3518 ft., and at 7465 ft. a 9⅝-in. string was landed. At 8743 ft. a string of 7 in. was set and cemented in order to test the regular 8700 ft. sand. It showed only water.

The 7-in. casing was then cut from 7590 to 7465 ft., and the lower portion was sidetracked.

A final 6-in. hole was drilled from 9772 to 10,600 ft., thus leaving 838 ft. of open hole.

Until the sidetracking job the hole was reported to be less than 3° off vertical.

The other Roanoke well has not had any sidetracking jobs, and the casing programme therefore differs from the Jarnigan No. 1 well.

The well was spudded with a 22-in. hole and the first string set was 16 in. landed at 186 ft. At 2857 ft. a 10¾-in. string was set and cemented. A 7-in. string was landed at 9619 ft., and below this is open hole of 6¼ in. in diameter.

A geological comparison between the two wells indicates that Jarnigan No. 1 is approximately 200 ft. lower on the geological markers, but the gas sands are practically even. L. V. W. C.

1124. Controlled Directional Well Drilling and Surveying Practice. Part I. J. D. Hughes. *Petr. Eng.*, July, 1935, **6** (11), 27.—The surveying of drill holes has become of paramount importance with the advent of controlled directional drilling. The surveying instruments most widely used are the multiple-shot and the single-shot photographic types.

In cased or partly cased wells, since it is impossible to obtain magnetic readings, the drill-pipe and instrument are oriented as they are lowered.

The methods of surveying are explained. L. V. W. C.

1125. Controlled Directional Well Drilling and Surveying Practice. Part II. J. D. Hughes. *Petr. Eng.*, August, 1935, **6** (12), 30.—The surveys of oil wells may be divided into two classes: (1) operative, and (2) informative.

In the first class the surveys are made concurrently with drilling progress by means of a single-shot instrument. By taking readings at specified intervals it is possible to compute the position and angular condition of the hole as it goes down.

Where an operator has to drill a well within specified angular limits, operative surveying is practised. This permits the operator to take corrective measures at the time they will be most effective and at a minimum expense and trouble. L. V. W. C.

1126. Drilling at Crystal. J. C. Albright. *Oil Weekly*, 12.8.35, **78** (9), 21.—The most difficult drilling feature in the Crystal field is encountered while penetrating the overlying surface formation known as the Glacial Drift.

The wells are generally started by cable tools, which are used to drive the first string of pipe through the drift, and the first string is usually 10 in. in diameter, weighing about 41 lb./ft. The joints of the drive pipe are short.

The drive pipe is set on the surface, and a drive head is placed on the tools fitted with driving slips. Drilling and driving are alternated with drilling preferred. When heaving sand is encountered, the pipe is driven ahead of the shoe.

When the hole is being drilled with cable tools, a heavy clayey mud is used.

L. V. W. C.

1127. Completion of Wells. J. L. Chaillet. *J.I.P.T.*, 1935, **21**, 654–660.—A paper with discussion on the organization and technical aspects of the completion of wells.
G. R. N.

1128. Speed and Weight Relationship with Drilling Footage. B. Mills. *Oil Weekly*, 22.7.35, **78** (6), 25.—The importance of speed of drill-pipe rotation and the weight carried on the bit are being studied to determine their effect in drilling the various formations in the principal producing districts of the United States.

An attempt has been made to check and measure drilling progress against speed of rotation and weight carried. The desire for straight holes has forced operators to seek the most practical drilling methods, but the increase in speed without the proportionate decrease in weight carried has resulted in many crooked holes.

The formations to be drilled are a factor of importance in the speed of rotation of the bit and the weight applied. Steady drilling progress is affected by pump pressures and mud volume.

The tendency in many districts has been to reduce the weight carried on the bit and to increase the speed of rotation. This has the effect of straightening crooked holes which have been caused by the application of too much weight.

Very heavy hydraulic pipe on the bottom of the regular drill string is being tried to give a steadying tendency to the entire column. L. V. W. C.

1129. Integral Tool Joint for Rotary Drill-Pipe. Anon. *Petr. World* (LA), 1935, **32** (7), 23.—A short article on the recently introduced method of upsetting drill-pipe externally as well as internally for the purpose of forming the tool joint thread integral with the drill-pipe, thus eliminating the threaded joint between drill-pipe and tool joint. The heavy wall of the upset which forms the tool joint can be so treated as to increase its hardness and strength against wear and stabbing action as compared to the body of the pipe, where ductility and impact resistance are more desirable.
W. W.

1130. Variable Generator Provides Direct-Current Lighting for Drilling Rigs. W. C. Lane. *Oil Weekly*, 5.8.35, **78** (8), 38.—A demand has been made during the last two years for an electric generator that will supply energy at a constant voltage when driven at widely varying speeds. One of the fields for such a generator is the lighting of drilling rigs powered by I.C. engines mechanically connected to their load.

Such a unit is now available, and a description of the unit, together with the principle on which it operates, is given. L. V. W. C.

1131. Diesel Electric-Powered Rotary on Oklahoma Wildcat. W. C. Lane. *Petr. Eng.*, July 1935, **6** (11), 27.—Attention has been directed to a wildcat being drilled in Oklahoma County by reason of the fact that diesel-electric power is being used.

It is the first occasion on which variable voltage system of speed control of this particular rating has been used on a drilling well.

About ten barrels of oil is ample daily fuel supply, and only one barrel of good water is required for the cooling system.

The power plant consists of two 175-Kw., 200-volt, 1200-r.p.m. differentially wound separately excited d.-c. Westinghouse generators and an exciter.

Two Superior diesel engines rated at 300 H.P. at 514 r.p.m. and 350 H.P. at 600 r.p.m. insure an abundance of power. L. V. W. C.

1132. Unique Rig Hookup. Anon. *Oil Weekly*, 5.8.35, **28** (8), 24.—The Noble Drilling Co. has recently installed a multiple-twin engine A.C. electric generating set at a test being drilled near Arkansas City.

The hookup consists of 3 horizontal twin-cylinder engines mounted on individual heavy steel skids and the generator lineshaft unit is securely bolted to them.

A description of the engine and electrical equipment is given together with pictures of the plant. L. V. W. C.

1133. Correct Treatment of Oilfield Boiler Water Based on a Few Simple Tests. E. Vigo. *Oil & Gas J.*, 8.8.35, **34** (12), 46.—Simple quantitative methods for measuring the hardness and the alkalinity of water samples are described and the different classes of boiler feed water and their treatment are discussed. Emphasis is laid on the fact that good results can only be obtained by exercising careful control over the method employed.

Figures for the possible economies which may be effected by careful attention to the boiler feed water are examined and a method for minimizing losses due to incrustation and corrosion of cooling coils and other heat exchange equipment, in which water circulates, is given. L. V. W. C.

1134. Oilfield Waters should be Treated to Eliminate All Destructive Elements. I. F. Bingham. *Oil & Gas J.*, 8.8.35, **34** (12), 48.—Most of the water used in the oilfields needs treating before it is fit for use on boilers and other plant, but this fact is not always realized. Both suspended matter and solids in solution must be considered.

Suspended matter may be eliminated by settling, followed by coagulation of any colloidal matter by alum, or some other coagulant, and further settling; but solids in solution offer the major problem.

The four ill effects of matter in solution in water on boilers and other such plant are corrosion, deposition of scale, foaming and caustic embrittlement of steel; and a table of the common impurities in boiler feed water is given, and their effects in use are discussed. Typical oilfield and river water analyses are shown and the various methods of reporting on the solids found are explained. L. V. W. C.

1135. Welding Casing Practice. B. Mills. *Oil Weekly*, 5.8.35, **78** (8), 19.—A technique in welding casing has been developed in the East Texas Field by the Sinclair Prairie Oil Co. which may have far-reaching effects on casing practices of the future.

The salvaging of a large quantity of 6⅝-O.D. 20-lb. plain end line pipe from a pipeline made this available for use in the East Texas wells.

After testing, bevelling and welding into 40–50 ft. lengths, the pipe is subjected to a cold-water pressure of 960 lb./sq. in.

A special jig for holding the pipe in place and aligning the two joints being welded has speeded up the operation and increased the accuracy of the spacing between joints. Tacking or spotting the joints is done with the jig in place, and this tool is then removed and the full weld completed.

The use of plain end pipe has many advantages over the screwed type under certain conditions, notably from a cost point of view. L. V. W. C.

1136. Cement for Oil Wells. D. E. Silcox and R. B. Rule. *Oil Weekly*, 29.7.35, **78** (7), 21.—Cements meeting the specifications outlined in the article have been used in cementing deep wells in California without giving the slightest trouble.

The mixing test, which is the most important of the tests described, can be modified to meet almost any set of well-cementing conditions, and thus tell accurately whether any particular cement is acceptable for cementing under those conditions.

L. V. W. C.

1137. Plug-Back Method. E. S. Post. *Oil Weekly*, 12.8.35, **78** (9), 48.—An improved plug-back cementing method has been employed in several South Texas wells.

In South Texas the area producing water is generally a sand or sandy shale separated from the regular oil horizon by a cap rock. The area between the base of the cap rock and the bottom of the hole is under-reamed to about double the diameter size of the hole. After under-reaming, the necessary amount of cement is pumped into the hole and held under pressure. L. V. W. C.

1138. Behaviour of Cement Grouts under Oil Well Conditions. S. L. Meyer. *Petr. Eng.*, July 1935, **6** (11), 51; Aug. 1935, **6** (12), 54.—The strength of concrete is affected by an excess of water, and other things being equal, the strength of concrete is inversely proportional to the quantity of mixing water used.

Temperature affects the consistency of a water-cement paste. Thus, as wells are drilled deeper, temperature will become a more important factor.

Cement fineness affects the quantity of water required to attain a certain consistency.

The compressive strength of cement is greater at high temperatures and high pressures than where high temperatures and no pressures are used.

Pressure accelerates setting times to only a small extent, irrespective of the percentage of water used.

Impurities in mixing water greatly lower the strength of the resulting concrete.

Bonding between well wall and cement and casing and cement is assisted by

expansion of the hardening grout. A graph is given showing the rates of expansion in water and contraction in air.

Mud contamination has a serious effect on the cement, and agitation may cause only a bulky, colloidal hydrated mass of cement and prevent it from setting.

L. V. W. C.

1139. Bibliography on Oil Well Cement. A. Reid. *J.I.P.T.*, 1935, **21**, 734–740.—A précis of 83 references on the properties of oil well cement. G. R. N.

1140. Complete Mud Reclamation Plant for a Single Well. W. A. Sawdon. *Petr. Eng.*, July 1935, **6** (11), 58.—Due to the high pressures encountered in the Lost Hills field, California, the use of weighting materials has become a necessity. In order that this material may not be lost, reconditioning is carried out. One company has installed a centrifugal separator for reclaiming the weight material from the waste mud.

A description and sketch of the plant are given. L. V. W. C.

1141. Rubber Hose Connection Solves Slush Pit Mud Line Problems. Anon. *Oil Weekly*, 26.8.35, **78** (11), 44.—Trouble with the coupling connections used on the mud line leading from the slush pits to the pumps has been of frequent occurrence. The terrific vibration set up by the reciprocating pumps causes the metal to crystallize and leaks develop. This allows air to be drawn into the pumps and then to the rotary drilling hose, causing a condition known as "water hammer."

This problem has been successfully solved by substituting a 5-ft. section of rubber suction hose at the point of the extreme angle and attaching it to the pipe with metal clamps. Vibration does not affect it, because of its flexibility and a permanent air-tight connection is maintained. L. V. W. C.

1142. Latest Mud Conditioning System and Control at Shepherds Mott Test. N. Williams. *Oil & Gas J.*, 18.7.35, **34** (9), 22.—Particular attention is being paid to the mud conditioning of a deep test now drilling at Shepherds Mott, Texas. The returns from the well are treated by a shale shaker, where most of the undesirable material is removed, and they then flow along a 100-ft. ditch, fitted with baffles, the whole being covered with corrugated-iron roofing to prevent excessive dilution of the mud in the event of rain. As the well is a test hole, a survey is taken daily, and while this is going on, the ditch is thoroughly cleaned out. The mud then goes through two settling pits into the suction pit. The two mud pumps are installed in a cellar, so that there is gravity feed to the suction pipe, and the pump efficiency is thus increased. A stand-by pump, mixing pit and reserve pit are also employed.

The objective of the test is the lower member of the marine Oligocene at below 8000 ft., and the difficulty in this field is a troublesome shale section at about 5100 ft., which has, so far, beaten operators. Past failures are attributed to the use of too light equipment and a tendency to rush the drilling. The present test is being drilled very carefully and slowly, and an attempt will be made to core the entire shale section, as it is believed that the condition of the walls can be controlled better this way.

L. V. W. C.

1143. Connection between Yield Point and Viscosity of Rotary Drilling Fluid. C. W. Woolgar. *Oil & Gas J.*, 25.7.35, **34** (10), 40.—It is shown, from theoretical reasons, that the yield point of a mud is of more importance to the driller than the viscosity measured at some arbitrary shearing rate such as at 600 r.p.m. on a Stormer viscometer.

Using muds of varying density made up from four different clay samples, it was found that there was approximately a linear relationship between the yield point, measured in lb./sq. ft., and the viscosity, in centipoises at 600 r.p.m. on a Stormer viscometer, for muds made up from any given clay. Also it was found that the more colloidal the clay the higher the yield point for a given viscosity, and $\gamma = 0{\cdot}005$ to $0{\cdot}0075V$ in the above units according to the clay used, with $\gamma = 0{\cdot}006V$ for a normal drilling mud. L. V. W. C.

1144. Viscosity and Thixotropy of Drilling Mud. P. Evans and A. Reid. *J.I.P.T.*, 1935, **21**, 677–690.—A précis of a paper with discussion on the measurement of viscosity and its application to drilling mud and the effects of thixotropy.

G. R. N.

1145. Drilling-in with Gas Pressure and Oil. W. M. Sartain, jr. *Oil Weekly*, 29.7.35, **78** (7), 19.—The bottom-hole pressure on the east side extension in the Oklahoma City pool is much lower than that experienced on the south side. As a result the methods adopted for drilling into the sand in the older part of the field might be injurious to the sand on the east side by penetration of the drilling fluid.

The method adopted required the equipment as used in the older method together with a string of 4½-in. O.D. flush-joint drill-pipe, two special packers and a smaller steam pump.

A sketch is given showing the arrangement of the various parts of the equipment.

After the cement plug was drilled out, the kelly packers were put on. These packers enable the kelly to rotate, but prevent the escape of gas and oil between the table and the kelly. A short drill collar replaced the usual one, and the float valve was put in just above the collar. A separator was then connected up to the flow line.

Gas was then turned in through the drill-pipe and circulated until all the rotary fluid was blown out of the casing into the separator, where it was drained off into the mud pits. As soon as all the mud was blown out, the oil pump was started and oil was pumped down the drill-pipe with the gas still circulating.

Drilling was then conducted in the usual manner. To add a new length of drill-pipe, the pipe was raised to the full length of the kelly and the oil pump stopped, but allowing the gas to continue to flow into the drill-pipe to blow all the oil out of the pipe. The pipe was rotated slowly during this operation. As soon as the drill-pipe was blown clean, the gas was shut off and the pressure drained off.

The packers were then removed and the string was raised until the joint was above the table. The new joint was then added.

When the well started to flow, the pipe was pulled through the rubbers of the gate, and the flow was carried to the separator during the entire trip. L. V. W. C.

1146. Sucker Rod Fatigue Changes with the Nature of Corrosive Elements in Oil. F. B. Bayless. *Oil & Gas J.*, 15.8.35, **34** (13), 26.—The three general classes of sucker rod service and the three types of loads experienced are tabulated and several machines for testing the endurance limit, the impact resistance, and the corrosion fatigue are described. Where the rod acts under stress only and corrosion is absent, service conditions can be reliably predicted from the results on laboratory test machines, and such rods, when overloaded, fail from fatigue only.

When corrosive conditions are present, the problem of predicting the behaviour of rods is complicated by the lack of reliable data on corrosion effects, which cause pitting and reduce the fatigue resistance of the metal.

The most severe type of service is that in which hydrogen sulphide corrosion and embrittlement are present: it is probable that more money has been spent in developing rods capable of resisting this type of corrosion than any other, and the problem is by no means completely solved, especially in the correlation of laboratory test results with service conditions.

Tables of test results, chemical composition and physical properties of sucker rods for various types of service are given. L. V. W. C.

1147. A Simplified Well Dynamometer. J. C. Slonneger. *Petr. Eng.*, August 1935, **6** (12), 51.—A simplified dynamometer, known as Falk Wellometer, has been recently developed.

The principle of operation is that of a telemeter. A measured portion of the rod on which the load is to be determined is gripped by clamps, and the change in length of that measured portion is magnified and indicated on a dial instrument.

L. V. W. C.

1148. Development of Wire Rope Pumping in Rumania. P. R. Clark and L. F. W. Schropp. *J.I.P.T.*, 1935, **21**, 691–700.—A paper with discussion on the problems encountered in wire rope pumping. G. R. N.

1149. Disposing of Oilfield Brines. L. Schmidt, H. M. Thorne and C. J. Wilhelm. *Petr. World*, 1935, **32**, 103–106.—A review of salient points pertaining to the general problem of brine disposal, and of the facts that have been developed by the present co-operative study of this subject in Kansas. Shows the magnitude of the problem and indicates the many factors that will require detailed study before an ultimate solution can be reached. Methods, briefly referred to in the paper, have been found

which, if used in accordance with good engineering practice, should reduce to a marked degree the contamination of fresh-water sources by oilfield brines. W. W.

1150. Problem of the Shut-in Well. G. J. Hausen. *Petr. World* (LA), 1935, **32** (7), 51.—Experience has shown that in certain circumstances wells too long idle may not be restored to their former productiveness and the surface improvements necessarily depreciate. It has also shown that most of these wells can be restored to their normal yield, and in many instances production materially increased, if the wells are properly cleaned out, water infiltration, if any, corrected and the work of reperforating done where indicated. Redrilling and deepening a well will often restore and increase production and more than justify this expenditure. If the history and location of any particular well show that it was shut-in because the life of the well indicated exhaustion of its oil supply, or pronounced water infiltration was present, then the wisdom of cleaning and redrilling becomes of importance, and the permanent abandonment of the well should be seriously considered. The conclusion as to whether any such doubtful well should be permanently abandoned and this investment written off, is materially aided by work sufficient to test the probability of its restoration to productiveness, and, in the author's opinion, this work is often most advisable.

Modern portable hydraulic and plugging machines have been built, and are now in general use, and have proved very efficient in the work of fishing, cleaning, washing, bailing, plugging, cementing, mudding wells under pressure and pulling casing from wells. W. W.

1151. Gravity Gathering Systems Aided by Following Natural Stream Channels. L. G. E. Bignell. *Oil & Gas J.*, 8.8.35, **34** (12), 45.—In the Lucien field of Logan County, Oklahoma, the gravity-gathering system has been very successfully applied. At each well separators have been installed on structures high enough to allow the oil to drain by gravity to low lease tanks. These are carefully located so that the oil can flow from them to three large-capacity storage tanks, from whence it is pumped away. The system takes advantage of the natural slope of the ground and avoids high points between tanks and pipe-line terminals.

When a new pool is opened up, a careful survey of the ground is necessary in order that the gathering system may be economically planned, and if possible permit the gravity method to be used. Generally natural stream channels can be followed with success.

Air pockets in gravity lines must be avoided, if possible, by bringing all points on the line below the hydraulic gradient of the pipe, but if this is impossible, suction pumps at the lower end of the line will help to overcome this difficulty by changing the theoretical hydraulic gradient line so that in practice no point comes above this. L. V. W. C.

1152. Stripper Oil Economically Handled by Rod-Line Pumps and Small Stations. L. G. E. Bignell. *Oil & Gas J.*, 25.7.35, **34** (10), 38.—The problem of the collection of the oil from nearly 2000 wells with an average production of only 1·875 brl. per day was solved in an Oklahoma field by the installation of small rod-line pumps operated by jerk-line from the central pumping plant. These pumped the oil from the lease tanks, where it was gauged, by 2-in. lines to a larger-capacity tank battery specially designed to reduce evaporation losses. Here emulsions were broken down and salt and water separated out. From these secondary tank batteries a 4-in. diameter line takes the oil to the central gathering station, where it is metered and pumped to the refinery.

An ordinary water meter was used for this purpose, and on test against the more normal method of gauging the two measurements showed a difference of only 0·067% over a period of 10 months. The system was found to be efficient, cheap and flexible, and compared well with other types of gathering systems. L. V. W. C.

1153. Cut Oil Treating Units. J. C. Albright. *Oil Weekly*, 26.8.35, **78** (11), 33.—Separation of water and oil of the Porter Township field of Michigan is a difficult feat because the water remains partly in suspension even in warm weather.

The Pure Oil Company's engineers have solved the problem by the design of a heater which may be easily installed into the older treating units in use.

A complete description of the new installations is given together with pictures of the plant. L. V. W. C.

1154. Small Individual Heaters for Treating Cut Oil at Wells. J. C. Albright. *Petr. Eng.*, August 1935, **6** (12), 102.—The oil produced in the Playa del Rey field is cutting so excessively that many companies are installing miniature heaters used in conjunction with some sort of treating compound.

The heaters consist of two major units. One is the boiler of the vertical type of from 5 to 10 H.P., and the other is the oil heater which is constructed from various size cylindrical pipe.

A simple gas burner, controlled by a pressure-reducing valve placed in the fuel line, is installed in the combustion chamber. L. V. W. C.

1155. Gas Mixing Station. J. C. Albright. *Oil Weekly*, 5.8.35, **78** (8), 30.—All the white sand gas produced in the Kettleman Hills by the Kettleman North Dome Association must now pass through a mixing header before it is finally distributed to the companies taking the wet gas.

The installation and the metering and sampling devices are described in detail, as some of the equipment is new in design.

It is necessary for the gas to be delivered in the proper percentages of volume to the three companies taking the gas, regardless of the amount of gas being produced. The manner in which this is done is described.

A complete blend of the " white sand " and " black sand " gases has been possible with this header. L. V. W. C.

1156. Stage Separation, Application to Production of Crude Oil and Gas. Part I. R. L. Huntington, W. F. Cloud, P. E. Fletcher and W. R. Warren. *Oil Weekly*, 22.7.35, **78** (6), 19.—Deep drilling has resulted in the finding of oil and gas formations having higher formation pressures than were found in the shallower districts, and thus higher percentages of gases in solution. To conserve the energy stored in these dissolved gases it is necessary to produce the oil with a minimum gas–oil ratio.

Various methods have been devised to accomplish these results. Bottom-hole choking is an efficient device, but where a large part of the available pressure is required at the surface stage separation of the crude oil–gas mixtures must be performed.

Subjecting a mixture of hydrocarbons to some definite temperature and pressure may result in one of three different conditions existing: (1) total vaporization may take place, (2) total condensation may result, or (3) partial vaporization or partial condensation may occur.

Lindsly has described the three methods of liberating gas from a crude oil–gas mixture in another paper.

The results of the experimental work carried out in the development of stage separation are discussed. L. V. W. C.

1157. Stage Separation, Application to Production of Crude Oil and Gas Mixtures. Part II. R. L. Huntington, W. F. Cloud and W. F. Matheny. *Oil Weekly*, 29.7.35, **78** (7), 31.—The use of stage separation for crude oil–gas mixtures has made it possible for the producer to increase the A.P.I. gravity of his crude oil without appreciably increasing the evaporation losses in storage.

Further research is necessary to determine the quantitative effect of temperature, pressure, gas–oil ratio and the physical properties of the oil and gas to permit the design of stage separation systems on a more scientific basis. L. V. W. C.

1158. Gas–Oil Separators. J. W. Hardy. *J.I.P.T.*, 1935, **21**, 741–752.—A paper with discussion on the operation of gas–oil separators. G. R. N.

1159. Oil-Bearing Formation Characteristics Yield Vital Data on Repressuring. K. B. Barnes. *Oil & Gas J.*, 8.8.35, **34** (12), 31.—It is emphasized that to carry out repressuring successfully accurate data about all the possible factors involved must be obtained. A knowledge of the chemical composition and texture of the sand is necessary, and photomicrographic studies of various types of sand are given in the article showing their various characteristics.

Physical tests of oil and water saturation, porosity, permeability and grain size are also necessary, but the core sample must be thoroughly cleaned of oil, water and bituminous matter before testing.

From these data on cores from the well an estimate may be made of the oil content of the sand, the possible recovery from it, and its behaviour under repressuring conditions. L. V. W. C.

1160. Estimation of the Porosity of Limestone. W. H. Thomas, R. A. E. Chisholm and A. B. Cameron. *J.I.P.T.*, 1935, **21**, 725–733.—A description of two methods of estimating the porosity of limestone together with a method of determining pore size. G. R. N.

1161. Selective Wetting of Reservoir Rocks and its Relation to Oil Production. A. D. Garrison. *Oil & Gas J.*, 15.8.35, **34** (13), 37.—The general theory of surface tension and wetting of surfaces is explained, and it is pointed out that if water wet sand is in close contact with oil wet sand, the water will tend to displace the oil and drive it before it.

Some known reservoir rock materials have been investigated, and their adhesion tension values have been measured for various pure liquids and representative oils.

Spaces in producing sands are generally too small to permit complete settling of water to below the oil, as occurs in a bottle or pipe, owing to the capillary action and curvature of the surfaces which retard this settling.

Equilibrium will be set up in any crevice between the force of gravity, tending to pull the denser liquid down and the pull of the interfacial film with its convex side towards the water. From curves showing the relationship between the contact radius of curvature of oil–water and the height of the contact above the non-capillary level, it is shown that, in one case, even at 250 ft. above this datum line all pores up to 10^{-4} cm. radius are filled with water.

The theories of oil, water and gas distribution in the various kinds of reservoirs are mentioned and briefly discussed. L. V. W. C.

1162. Low Level of Fluid and Lack of Water Drive Create Pumping Problem. L. G. E. Bignell. *Oil & Gas J.*, 15.8.35, **34** (13), 24.—More than half the wells drilled to the Wilcox sand of the Oklahoma city field are on gas lift and most of the remainder are on pump, but owing to the falling off in bottom-hole pressure, gas lift requires up to 10,000 cu. ft. of gas per brl. of oil, and the method has become too expensive.

Various systems of pumping units have been installed, and are giving satisfactory service, but operators who have installed gas lift apparatus are naturally unwilling to scrap it until absolutely necessary. An attempt has therefore been made to develop a bottom-hole pump operating on compressed gas from the central compressor stations.

The gas is supplied at 350 lb./sq. in. through the casing, and in some cases it has been necessary to preheat it to avoid the cooling effect on the oil due to the gaseous expansion, which may cause solids in the oil to deposit in the tubing and result in a blockage.

It is probable that soon the Wilcox sand will be produced either by surface pumping outfits, or by this type of bottom-hole gas pump, in preference to all other methods. L. V. W. C.

1163. Five Spot Flooding Applied in Nowata and Rogers Counties of Oklahoma. *Oil & Gas J.*, 8.8.35, **34** (12), 40.—Water-flooding operations in N.E. Oklahoma have been going on for the last four years. In one lease production, which had fallen to only 6 brls. per day, increased to 80 brls. per day under the influence of flooding: 44 intake wells took about 2000 brls. of water per day at 275 lb./sq. in., with a well spacing of 220 ft., and both straight and delayed flooding was used.

Various other flooding projects are being carried out, all on the five spot spacing system of the production well at the centre of a square with a water well at each corner, and they are mentioned in detail.

Few flooding schemes are being carried out elsewhere, and the economies of the subject require careful consideration before a decision is made. L. V. W. C.

1164. Supply of Water for Lease Purposes may be Developed by Planning. I. F. Bingham. *Oil & Gas J.*, 1.8.35, **34** (11), 32.—Ensuring an adequate supply of water is one of the most important factors in the successful development of an oilfield, and enormous monetary losses have occurred as the result of inattention to this point.

The various factors influencing the choice of the particular source of water to be used are tabulated and the most frequently occurring systems of oilfield water are described and their relative advantages and disadvantages discussed. A description is then given of the plant and general layout of a typical oilfield water system in the Oklahoma City field. L. V. W. C.

1165. Patents on Drilling Apparatus. J. A. Zublin. U.S.A. 2,005,767, 25.6.35. Method and apparatus for operating oil wells by disintegrating the gas-charged oil to release the gas.

B. F. Blanchard. U.S.P. 2,005,819, 25.6.35. Core drill.

M. Stone and R. Bandry. U.S.P. 2,005,819, 25.6.35. Control means for rotary well drilling equipment.

H. G. Dillon and H. C. Jenks. U.S.P. 2,005,889, 25.6.35. Automatic drilling device for rotary drilling equipment.

R. R. Renauf. U.S.P. 2,005,955, 25.6.35. Well packer.

C. E. Burt. U.S.P. 2,005,989, 25.6.35. Core barrel.

G. L. Kothny. U.S.P. 2,006,556, 2.7.35. Method of orienting whipstocks.

A. Boynton. U.S.P. 2,006,909, 2.7.35. Automatic heading device.

E. Burns. U.S.P. 2,007,155, 9.7.35. Crown block.

C. E. Burt. U.S.P. 2,007,465, 9.7.35. A method for determining the exact position of the drilling bit at any moment by means of a colouring agent.

W. L. Church. U.S.P. 2,007,519, 9.7.35. Casing perforator.

E. A. Smith. U.S.P. 2,007,666, 9.7.35. Water-tight telescopic kelly.

G. K. Toggard. U.S.P. 2,008,114, 16.7.35. Air or gas lift pump.

J. Bigg. U.S.P. 2,009,989, 30.7.35. Oil-well casing head.

A. Boynton. U.S.P. 2,010,135, 6.8.35. Automatic heading device.

H. P. Wickersham. U.S.P. 2,010,284, 6.8.35. Casing head.

R. D. Fisher. U.S.P. 2,010,587, 6.8.35. Joint for connecting parts of well-drilling and well-pumping equipment.

A. Boynton. U.S.P. 2,010,807, 13.8.35. Automatic stage lift flowing device for oil wells.

W. J. Dunlop. U.S.P. 2,010,947, 13.8.35. Sand and gas separator for well pumps.

J. H. Howard. U.S.P. 2,010,992, 13.8.35. Valve protecting device for well control head.

F. C. Smith. U.S.P. 2,011,089, 13.8.35. Flushing device for drill stems.

J. W. Woods. U.S.P. 2,011,100, 13.8.35. Fluid choke. L. V. W. C.

Class 400. Transportation, Storage and Distribution.

1166. Reconditioning of Large Pipe-Lines is Occupying Attention of Companies. N. Williams. *Oil & Gas J.*, 18.7.35, **34** (9), 32.—Many large lines have now reached the stage where it is thought advisable to recondition them, and the handling of this large pipe—18 in. and over—has, in some cases, meant the building of especially heavy equipment.

In one case the pipe is uncovered by a ditching machine, raised, uncoupled and is then generally welded up into 100-ft. lengths, which are then cleaned by a special travelling cleaning machine which is said to be the largest of its kind in the world, and which can handle about 2500 ft. of pipe a day. The pipe is then coated with bitumastic covering welded up, with a Dressler coupling every 200 ft., and reburied. L. V. W. C.

1167. Unique Line Repair Job. E. Sterrett. *Oil Weekly*, 12.8.35, **78** (9), 28.—After being in service only 3 months, an 8-in. line in East Texas ruptured under a pressure of 900 lb./sq. in. at the pump station 4 miles away.

A quick repair was necessary, and a 3-ft. long sleeve was clamped around the 18-in. split. This repair lasted nearly 4 years before another breakdown occurred.

A permanent repair job was then carried out by means of another sleeve, which was cemented and welded into place. L. V. W. C.

1168. River Crossing Failure. E. Sterrett. *Oil Weekly*, 26.8.35, **78** (11), 17.—An 8-in. crude oil line, looped for greater safety at its crossing of the Red River, gave way on one branch, and then, a few hours later, lost the loop line also. Due to the new high-water record, at the time it was possible only to isolate the damaged crossings with the gates at either side.

It was found that the pipe had been pulled in two, the channelward section disappearing. When this was found, this section lay toward midstream and down current, and it was disclosed that this length was isolated by a second break.

It was found that the second rupture was caused by compression across a diameter as though bent sharply through 90° or more.

When finally located, the two ends from the second break were cut off and the fracture was closely studied. The new pipe was welded to the usable portion remaining. L. V. W. C.

1169. Set up of New General Petroleum Line Effects Marked Pumping Economy. W. E. Archer. *Oil & Gas J.*, 25.7.35, **34** (10), 47.—General Petroleum Corporation has increased its facilities from the north to its Los Angeles and Torrance refineries by a new 89-mile 10-in. welded pipe-line from Lebec, on the north of the Tehachapi mountains, to Torrance, 16 miles south-west of Los Angeles, and has thus reduced the necessary pumping stations on this route from five to one, the initial one, besides increasing its daily capacity by about 40,000 brls.

The work was divided into three sections, and 35 miles of pipe had to be machine-painted and wrapped owing to the corrosive nature of the ground in one part of the route: ditching machines were chiefly used, although much hand work was necessary through towns.

Welding was done in the normal manner, the pipe being of the double bell type with a "chill" ring to form a base for proper penetration of the weld metal, and special electrical insulating precautions were taken at the crossing of the various electric railways encountered.

The work went through without any serious hitch, and production was started within a few hours of finishing the line. L. V. W. C.

1170. Crystal Field Outlets. J. C. Albright. *Oil Weekly*, 19.8.35, **78** (10), 24.—The production from the Crystal Township field in Central Michigan was at such a level that the movement of crude became a problem.

Since the field was discovered in March 1935 four pipe-lines have been laid to move the oil to various points.

Temporary stations have been built in permanent locations, but a considerable quantity of the oil produced is moved through tank truck units. L. V. W. C.

1171. Standard Oil Pipe-Line. Anon. *Petr. World* (LA), 1935, **32** (4), 22.—The 108-mile 12-in. pipe-line between Rio Bravo and Estero Bay is now in operation, and this article describes the lay-out of the new line and makes brief references to the equipment in the pumping stations. As a precaution against earthquakes where the line crosses the San Andreas fault, the line is left uncovered for a distance of more than 400 ft., and runs round a curve between 200 and 300 ft. in length, which, it is estimated, is sufficient to take up any reasonable shift without breakage. W. W.

1172. Iraq Pipe-Line Construction. Anon. *World Petr.*, 1935, **6**, 61–64.—A general review of the problems presented by the character of the territory which the 1180 miles of main pipe-line traversed. W. W.

1173. Physical Features of Iraq Pipe-Line. Anon. *World Petr.*, 1935, **6**, 64.—Sizes, total lengths and weights per foot of the pipe used in the construction of this line are given. Number and capacities of the tanks installed at the various stations and elevations along the route of the line are also stated. W. W.

1174. Welding 177,000 Joints of the Iraq Pipe-Line. J. F. Lincoln. *World Petr.*, 1935, **6**, 82–84.—Brief description of the work of welding the pipe-line, which was carried out in record time. The welds in all cases are $\frac{3}{8}$ in. thick, 30° bevel, tight butt with chill ring. Fifty-four welding machines were employed using $\frac{1}{4}$-in. electrodes for the first bead and $\frac{5}{16}$-in. electrodes for the second. W. W.

1175. Transport's Great Part in Iraq Construction. J. F. Winchester. *World Petr.*, 1935, **6**, 65–68.—Outlines the service obtained by a fleet of approximately 500 automotive units and the conditions under which transport operations had to be carried out. Movement of materials and supplies aggregated 23,000,000 ton-miles, and the distance covered by the motor fleet was 18,000,000 miles. W. W.

1176. Creating an Iraq Communications System. W. T. West. *World Petr.*, 1935, **6**, 69–72.—Outlines the task of stringing a thousand miles of telegraph and telephone wire across the trackless desert, the work being carried out rapidly to serve in the construction of the pipe-line. The rate of progress aimed at was one complete mile/day, and in practice this was far exceeded. The line consists chiefly of 25-ft. overall

poles, sunk 4 ft. 3 in., carrying one Australian carriwood arm with 4–300 lb. cadmium copper wires. At the present time the telephone and telegraph department is dealing with 2900 messages per week over the whole system, with 1800 in and out of the Hafia telegraph office alone. Telephone trunk calls are dealt with at the rate of 2000, in and out, per week. W. W.

1177. Moving 4400 Ton-Miles of Oil/Minute. Anon. *World Petr.*, 1935, **6**, 76–81.—A description of the engines, pumps, jacket-cooling water heat exchangers and auxiliaries in the twelve main pumping stations installed to propel Iraq Crude Oil across the desert from Kirkuk to the Mediterranean. W. W.

1178. Mixing Header Solves Gas Distribution Problem. A. C. Lyles. *Petr. World* (LA), 1935, **32** (4), 20.—This article describes a mixing header installed by the Kettleman North Dome Association to provide equitable distribution of wet gas which the Association supplies to three gasoline processing companies. The gas is obtained from two areas; that from the discovery area, or so-called white oil wells, contains higher percentages of pentanes and heavier hydrocarbons in relation to the charcoal results than does wet gas from the low gas/oil ratio black oil wells. Since a substantial portion of the butanes are discarded in the refining process, a higher efficiency was obtained when treating white oil gas. The header was built for a capacity of 200,000 million c. ft./day, and under such a load there are approx. 120 m. c. ft. and 80 m. c. ft. entering the header through 20- and 14-in. lines, respectively. The two lines intersect a 26-in. header at right angles, but from opposite directions and at different points. All lines are in the same plane. The 26-in. header then branches to two 5 × 12-ft. scrubbers, each having a capacity of 100,000 m. c. ft./day. Gasoline, water and crude oil are removed effectively and discharged by float mechanism to the condensate gathering system. The average pressure at the mixing header is 440 lb./sq. in., and the temperature of the gas is about 130° F. W. W.

1179. Delivery Cocks for Tank Cars. H. Richter. *Oel u. Kohle*, 1935, **11**, 540–542.—The disadvantages of the usual type of cock, as a consequence of the large area of rubbing surface involved, are avoided if a valve of the ball type is used. A special valve is described in which the ball is completely withdrawn from its seating by turning the handle through 90°. P. G. H.

1180. Pressure Type Tanks Augment Water Transportation Facilities in Winter. *Oil & Gas J.*, 8.8.35, **34** (12), 41.—A description is given of two spheroid tanks, one of 80,000 brls. and one of 60,000 brls., which have recently been erected at Muskegon, Michigan, for an oil company.

They cover about ¼ acre each and are 40 ft. high. Special safety devices are fitted, and it is claimed that evaporation losses and fire risks are reduced to a minimum.

The tanks will be filled in the summer months, while water transportation via the Great Lakes is possible, and will act as a source of supply for about 100 miles radius in winter. L. V. W. C.

1181. Rubber Hose Facilitates Loading Oil Tanker Anchored Far from Shore. L. L. Horchitz. *Oil & Gas J.*, 15.8.35, **34** (13), 30.—Tankers cannot approach nearer than ¼ mile to the shore at one Californian oil company's docks, so the oil is pumped out to the boat by 1200 ft. of 8-in. rubber hose coupled in 50 ft. lengths. The hose is floated by hermetically sealed drums and is towed out by a launch.

Loading time takes from 8 to 18 hours, while rigging up the hose occupies about 40 minutes, and the line will pump 15,000,000 brls. before renewal is necessary. L. V. W. C.

1182. Economical Gas Tight Lease Storage from Reconditioned Steel Tanks. L. G. E. Bignell. *Oil & Gas J.*, 18.7.35, **34** (9), 24.—On completion of the drilling of a lease on the Burbank field of Oklahoma it became necessary to provide lease storage tanks for the oil produced.

Two reconditioned 10 ft. diam. × 28 ft. horizontal crude oil storage tanks were cut in half, new bottoms welded on, and they were then erected vertically, together with two new tanks of similar diameter. A 2-in. equalizing gas line connects the tops of the six tanks, and by this means air is excluded, for on by-passing saturated vapour from full to empty tanks " breathing " is prevented and evaporation losses are reduced to a minimum.

By the prevention of evaporation losses a high A.P.I. gravity oil is retained, and it is calculated that more than 20 dollars a day are saved on the three wells producing into this tank battery over the old-time open-tank method of storage. L. V. W. C.

1183. Balloon Vapour-Saving System at Bulk Plants. Anon. *Nat. Petr. News*, **27**, 27.2.35 (9), 43.—Describes the balloon vapour system installed on storage tanks at the Continental Oil Co.'s bulk plant at Tulsa, Oklahoma. The system has resulted in a considerable reduction of evaporation losses. W. W.

Class 500. Properties and Their Determination.

1184. Improved Methods of Examining Mineral Oils. I. J. C. Vlugter, H. I. Waterman and H. A. van Westen. *J.I.P.T.*, 1935, **21**, 661–676.—Based on their extensive experiments, the authors describe a method of calculating the composition of a lub. oil by determination of its mol. wt., refractive index, specific gravity and aniline point. G. R. N.

1185. Improved Methods of Examining Mineral Oils. II. J. C. Vlugter, H. I. Waterman and H. A. van Westen. *J.I.P.T.*, 1935, **21**, 701–708.—In continuation of previous work (Part I), experiments are described on the specific dispersion as a means for the detection of aromatic rings and other unsaturated compounds in hydrocarbon mixtures. G. R. N.

1186. Forgotten Property of Gasoline. [**Volatility.**] J. O. Eisinger and D. P. Barnard. *J.S.A.E.*, 1935, **37**, 293–300.—Until recently the changes in the physical and chemical properties of gasolines have been governed largely by economic conditions rather than by automobile design. The present article deals with the results obtained in performance of a 1931 Buick car in accelerating from 10 to 38 m.p.h. on a 5·5% grade with various manifold wall temperatures and fuels of varying volatility. Variations in "front end" volatility were graded from the percentage distilled (A.S.T.M.) at 158° F., and "total" volatility was measured by the 90% evaporated temperature. It was found that a given improved performance could be obtained by varying combinations of "front end" and "total" volatility in a variety of ways, and a comprehensive set of curves shows the effect of these variations in a very clear manner. Curves are also shown which indicate minimum "front end" and maximum "total" volatility for satisfactory acceleration from 10 m.p.h. The authors conclude that engine performance can be materially improved by proper attention to volatility improvements, and think that seasonal adjustment of fuels will become of increasing importance. C. H. S.

1187. Proposed Index for Fuel Volatility. L. E. Hebl and T. B. Rendel. *Nat. Petr. News*, 24.7.35, **27** (30), 36.—The authors propose a method for rating the volatility of a gasoline based on the 20% and 70% recovery temperatures in the A.S.T.M. distillation test.

Data obtained from actual engine tests are given which show the relationship between the index so deduced and startability, "warming-up" quality, acceleration, fuel consumption, etc. They also discuss the effect of engine design, atmospheric temperature, etc., on various pertinent characteristics of the fuel. H. G.

1188. Development of Reid Vapour Pressure Test. R. R. Crippen. *Petr. World* (LA), 1935, **32** (4), 66.—Reviews the history of the growth of the method in its application to Pacific Coast operations, outlines the present standard and enumerates the variables in conducting tests. W. W.

1189. Boundary Friction of Oxidized Lubricating Oils. E. R. Redgrove. *J.I.P.T.*, 1935, **21**, 612–643.—A paper with discussion on the author's experiments on the static friction of mineral lubricating oils before and after oxidation and addition of fatty acids. G. R. N.

1190. Applications of Dielectric Constant in the Oil Industry. R. Bull. *Oel u. Kohle*, 1935, **11**, 499–503.—Owing to its sensitivity to polar compounds, and the high accuracy with which it may be measured, dielectric constant is stated to be suitable for controlling various refining and testing operations. The order of its value for a given distillate depends on the nature of the crude, the origin of which may be thus

identified. In general, the dielectric constant increases with rising viscosity, but in certain series of lubricating oil raffinates a maximum value has been observed at 8·5–15° E., the value then becoming less at higher viscosities.

By the theoretical Maxwell relationship, the dielectric constant, for substances in which it is $\geqslant 3$, is equal to the square of refractive index (n). In the case of paraffin hydrocarbons, however, it runs parallel with, but not equal to n^2. The actual divergence from n^2 allows conclusions to be reached as to the content of aromatics and unsaturateds in a given oil; as refining becomes more drastic, the dielectric constant falls continuously until, finally, the theoretical value for paraffins is reached.

During service, the dielectric constant of a motor oil increases owing to the formation of polar oxidation products. In certain cases, a better control of fractional distillation may be achieved if dielectric constant instead of temperature is plotted against recovery. A rapid method of estimating moisture in such materials as active carbon, adsorption earths, etc., is described. A weighed quantity of sample is stirred with a solvent of the dioxan type, the water content of which is then obtained from the increase in its dielectric constant. The original dielectric constant of dioxan is taken as 2·23, whilst that of water is about 80. P. G. H.

1191. Viscosity as a Function of Volume and Temperature of Oils. R. B. Dow. *Physics*, 1935, **6**, 270.—The viscosity–volume data of Kleinschmidt and Dow have been examined at various pressures and temperatures for lard, sperm and Pennsylvania mineral oil. The viscosity–volume isotherms at 25°, 40° and 75° C. are not identical for any of the oils studied, indicating that viscosity cannot be a function of the specific volume alone. P. D.

1192. Velocity-Gradient Methods in Rheology. E. G. Richardson. *Physics*, 1935, **6**, 273.—Since in a colloidal or quasi-plastic material, the viscosity is a function of the rate of shear, it seems best to determine the velocity gradient across a section perpendicular to the direction of flow under shearing forces, and to determine the coefficient of viscosity under a given velocity gradient. An account is given of the methods at present available for this purpose, and a method indicated by which the viscosity may be calculated from such measurements. The viscometers described comprise instruments based on optical, electro-magnetic, hot wire and colour band principles, respectively. P. D.

1193. New Viscosity Conversion Chart. M. G. Van Voorhis. *Nat. Petr. News*, 10.7.35, **27** (28), 32.—A new chart for the interconversion of Kinematic, Saybolt Universal, Saybolt Furol, Engler and Redwood I scales is described. H. G.

1194. Combustion of Gas–Oil and Heavy Oils. M. Aubert and co-workers. *Chim. et Ind.*, 1935, **33**, 811.—Referring to the indications that can be obtained by photographical registration of the combustion flame of gas mixtures and their relation to the detonation of the fuel, the authors report their investigations on the applicability of a testing method similar to that used for injection motors. A description of such a method is published in No. 11 of the "Publications Scientifiques et Techniques du Ministre de l'air" (of France). In fact, analogous phenomena are observed in the case of gas oil–air vapour in comparison with gasoline–air mixtures. Moreover, it was found that the additional injection of alcohols, aldehydes, etc., on the right moment, suppresses knocking. P. C. K.

1195. Knock Characteristics of Gasolines. T. Suwa. *J. Fuel Soc. Japan*, 1935, **14**, 74–81.—The octane numbers of 21 gasolines available on the Japanese market were determined by the C.F.R. Motor Method and found to cover the range 50–69, the average being 61. Similarly a low-temperature tar oil and a shale oil had octane numbers of 66 and 50, respectively. The compression ratio for incipient knock was measured for several of the above gasolines at mixture temperatures of 200° F. and 300° F., and it was shown that with rise of octane number the increase of compression ratio in changing from 300° to 200° F. tended to become greater. In general, an increase of 100° F. in mixture temperature caused a fall of 6 units in octane number. The exhaust temperature also varied with compression ratio, and it was observed that about 11·5% gain in power and 10° C. fall in exhaust temperature were obtained by raising the C.R. from 4·5 to 5·5. The blending octane numbers of a number of hydrocarbons, alcohols and phenols were also determined, and the results obtained were found to be in general agreement with those of other investigators. G. R. N.

1196. Thermal Reactions of Gaseous Hydrocarbons. G. Egloff and E. Wilson. *Ind. Eng. Chem.*, 1935, **27**, 917.—The results of previous workers in the field of hydrocarbon pyrolysis have been examined in detail on the basis of activation energies for primary and secondary reactions. This thermodynamic study has shown that a detailed examination of the thermal reactions of ethylene gives a key to the decomposition of any hydrocarbon, because ethylene is invariably an important pyrolysis product at temperatures below 750° C., and because, at temperatures above 750° C., the products are essentially the same as those from ethylene at that temperature.

Ethylene may undergo five types of reaction—*i.e.* polymerization, hydrogenation, dehydrogenation, carbon–hydrogen scission and scission of the double bond, and the products of pyrolysis of any hydrocarbon may be accounted for by these reactions. Polymerization appears to take place by a combination of ethylene molecules or vinyl radicals, and not by combination of methylene radicals, and the relative ability of olefines to polymerize depends on the chemical structures. Isomerization of olefines involves low energies of activation, and is consequently favoured by low temperatures and long contact times. The mechanism for the formation of aromatics from ethylene has not yet been definitely established, although the combination of six methylene radicals with the expulsion of six hydrogen has been suggested. Similarly the exact relationships determining the effect of pressure on pyrolytic reaction remain undecided. D. A. H.

1197. Hydrogen Content of Solid and Liquid Fuels. — Lambris. *Chem. Z.*, 1935, 592.—The hydrogen content of solid and liquid combustibles is determined by burning 0·5–1 g. of the substance in a bomb into which $BaCO_3$ has been introduced, under oxygen pressure. The quantity of water vapour escaping on releasing the pressure is calculated by a new formula. The nitric and sulphuric acids are neutralized in the condensate. The bomb is flushed out with absolute alcohol and the alcohol–water–precipitate weighed. The water and the H_2 contents are then determined by the method of Dolch. L. S.

1198. Removal of Mercaptans from Naphtha by Caustic Soda. I. Happel and D. W. Robertson. *Ind. Eng. Chem.*, 1935, **27**, 941–943.—Mercaptans are present in petroleum distillates in the form of free HSR in the oil, NaSR in the caustic layer and in the form of the SR-group. It is emphasized that the mercaptan sulphur content of a petroleum distillate must not exceed 0·001% by wt.

A method is described for the removal of mercaptan sulphur by washing with caustic soda containing 0·5 lb./gallon of NaOH at 40° F., in a two-stage counter-current system. In the first stage crude naphtha is bubbled through partly spent caustic soda, and in the second stage the washed naphtha is intimately mixed in a centrifugal pump with fresh caustic soda and allowed to settle.

The efficiency of the extractions of each of the stages is determined by computing the free caustic concentrations at the end of each stage and from the distribution coefficients. The mercaptan concentration can be calculated in lb./gallon for all components leaving the first and second stages. W. S. E. C.

1199. Estimation of Bromine or Iodine Numbers of Mineral Lubricating Oils. E. E. Cassimir and M. Dimitriu. *Petr. Zeit.*, 14.8.35, **31** (33), 1–4.—The estimation of the bromine value by the McIlhiney method is described and compared with the Wijs method for iodine value. The effects of reaction time, of excess of bromine and of the chemical composition of the solvent are discussed, and results given for addition and substitution indexes for some Rumanian, French and American oils.

The bromine addition index can sometimes be less than the actual value, since hydrogen bromide evolved from the substitution reaction is still in excess and is titrated; the hydrolytic effect of water present in reagents is also detrimental.

In order to remedy these defects, which are more perceptible the more numerous the substitution derivatives, the test must be carried out under the following conditions: (1) in not too great an excess of halogen (50–70% of the necessary quantity); (2) in a short reaction time of 15–30 minutes; (3) the reaction to take place in the dark at low temperatures; (4) the titration of the hydrogen bromide corresponding to the iodine must be done immediately after the addition of iodate solution, and only until the solution remains decolorized for some seconds.

The Wijs method when applied to mineral lubricating oils gives higher values for the substitution reaction than would correspond only to the addition of halogen.
W. S. E. C.

1200. Procedure for Classification of Hydrocarbons. S. P. Mulliken and R. L. Wakeman. *Ind. Eng. Chem., Anal.*, 1935, **7**, 275–278.—Hydrocarbons are classified in three groups: (A) gaseous of which there are only 22 in all, (B) liquid comprising (1) aromatic, (2) unsaturated non-aromatic other than alkenes, (3) alkenes (4) *cyclo*alkanes and (5) alkanes and (C) solid hydrocarbons divided merely into aromatic and non-aromatic.

All aromatics have a density above 0·84 at 20°/4°, but not all hydrocarbons of density above 0·84 are aromatic. Most aromatics are distinguished from non-aromatics by miscibility with an equal volume of nitromethane at a given temperature depending on the mol. wt. or b. p. of the hydrocarbon. On a graph the nitromethane points of aromatics and non-aromatics are separated by a clear zone. Determination of the miscibility of an unknown hydrocarbon with nitromethane at a temperature within the clear zone will indicate whether the hydrocarbon is aromatic or non-aromatic, unless it be acetylene, allene or conjugated diolefin. The latter may be distinguished from aromatics by density, which will be less than 0·84 at 20°/4°. The density of known *cyclo*alkines is between 0·84 and 0·86 at 20°/4°. The alkines tested were entirely miscible with H_2SO_4 of density 1·84 at 20°, which distinguishes them from aromatics of density below 0·86 which have saturated side chains and are not completely miscible with H_2SO_4 at 20°. Combination of the above tests usually makes it possible to distinguish an aromatic from a non-aromatic hydrocarbon. A bromide–bromate titration can be carried out on a non-aromatic to determine unsaturation and its degree. If less than three atoms of bromine react with each hydrocarbon molecule, the aniline point and density will more precisely define the type of alkene. Open-chain saturated hydrocarbons can be distinguished from the closed-chain type by miscibility with benzyl alcohol at specified temperatures. Solid hydrocarbons can be classified by physical constants, no general procedure being developed. G. R. N.

1201. Direct Determination of Total Oxygen in Oils. M. E. Marks. *Ind. Eng. Chem., Anal.*, 1935, **7**, 102–103.—The oxygen content of some oxidized oils was determined by the ter Meulen method suitably modified. The modified method consisted of passing the vapours of the oil contained in a quartz boat, placed in a combustion tube, in an atmosphere of hydrogen over a very active thoria promoted nickel catalyst, thereby converting all the oxygen to water, which was retained in weighed tubes of calcium sulphate. Instructions on the conduct of the method are given together with results on four oxidized oils. G. R. N.

1202. Formation of Alicyclic Hydrocarbons from Free Radicals. F. O. Rice and O. L. Polly. *Ind. Eng. Chem.*, 1935, **27**, 915.—Experiments are described in which diheptyl mercury was distilled at 140° C. under approximately 25 mm. pressure and decomposed by passing a slow stream of carbon dioxide into the liquid compound maintained at a temperature of 100° C. The carbon dioxide containing some diheptyl mercury vapour was then passed through a Pyrex tube at 340–360° C. and the decomposition products caught in two traps at − 100° C.; the permanent gases were collected over water.

The products in the traps were then fractionated using a special column containing a nickel spiral. Four fractions were obtained, the first contained *cyclo*hexane, the second heptane, the third cyclic hydrocarbons and the fourth tetradecane and the exit gases contained ethylene. W. S. E. C.

1203. Pyrolysis of Propane in Presence of Water Vapour. J. W. Lang and J. J. Morgan. *Ind. Eng. Chem.*, 1935, **27**, 937.—Experimental work on the pyrolysis of propane at 600–700° C. in the presence of various quantities of water vapour and at a total pressure of one atmosphere absolute is described in detail. Over the range of propane decomposition examined (3·9–24·5%) steam was found to behave substantially as an inert diluent, and was utilized to investigate the decomposition of propane at partial pressures below one atmosphere absolute. It was observed, however, that at 700° C. determinable traces of carbon oxides were formed, but aldehydes were absent even at much higher temperatures.

Variation in propane partial pressure affects the course of the pyrolytic reactions involved, and the experiments described suggest the occurrence of bimolecular reactions.

The reactions found to occur are :

$$C_2H_2 \rightleftharpoons C_2H_6 + H_2$$
$$C_2H_6 \longrightarrow C_2H_4 + CH_4$$
$$2C_2H_2 \longrightarrow C_2H_6 + C_2H_6 + CH_4$$

and it is shown that, of the various mechanisms proposed for pyrolysis reactions, the dissociation hypothesis of Nef most satisfactorily agrees with the experimental evidence. D. A. H.

1204. Dehydrogenation Reactions: the Action of Se or Pd Coal on *cyclo*Pentane Derivatives at Elevated Temperatures. L. Ruzicka and E. Peyer. *Helv. Chim. Acta*, 1935, **18**, 676.—To avoid secondary and side-reactions the temperature of dehydrogenation may not exceed 350° C. Actually the behaviour of *cyclo*pentane derivatives was studied between 350° and 450° C.

The formation of aromatic compounds from 5-rings containing hydrocarbons cannot always easily be explained, considering the notable dissociation of atom groups in the circumstances of reaction.

Dehydrogenation reactions were completed in the presence of these catalysts with indene, α- and β-methyl indene, α- and β-methyl hydrindene, α-ethyl-indene and hydrindene, α-*iso*octylhydrindene, methyl*iso*propylhexahydrofluorene and 1 : 2-diethyl-*cyclo*hexene. P. C. K.

1205. Synthesis from Unsaturated Hydrocarbons. J. A. Niewland. *Ind. Eng. Chem.*, 1935, **27**, 851.—This paper is a general review of the reactions of unsaturated hydrocarbons, particularly acetylene and the dienes. Catalysis is given special mention, and reference is made to the production of acetone by the catalytic treatment of glacial acetic acid in the gas phase, the production of soluble synthetic resins from phenols, and the manufacture of organic acetates. Mention is made of the great use of mercury salts in catalytic reactions with methyl alcohol and of the catalytic properties of methoxyfluoboric acid, silicon tetrafluoride, and dihydroxyfluoboric acid. The ether compound $(C_2H_5)_2O{\cdot}BF_3$ of boron fluoride may also be used as an effective catalyst in the presence of mercury. Cuprous salts are effective catalysts for ethylenic and acetylenic hydrocarbon condensations, particularly in the preparation of monovinyl or divinyl acetylenes, but the mechanism of the catalysis is not definitely known. The reactions of the vinyl acetylenes, with particular reference to polymerization, and the possibilities of synthetic rubber production are reviewed. D. A. H.

1206. The Physical Constants of the Polymerization Products of Unsaturated Hydrocarbons. H. I. Waterman and J. J. Leendertse. *Rec. Trav. Chim.*, 1935, **54**, 139.—A continued study is made of the relation between chemical structure and physical constants or the physical constants mutual, the latter being useful in predicting physical constants (*e.g.* the viscosity) from others already known of simple, or groups of, unsaturated hydrocarbons.

For this investigation a series of *n*-2-pentene polymers obtained at 0° C. with $AlCl_3$ as a catalyst from a mixture of pentenes and a series of *iso*butene polymers were prepared. Of each fraction of *n*-2-pentene and *iso*butene polymer the following constants were determinated : the refractivity index, the specific gravity, the specific refractivity (Lorents-Lorenz), the aniline point, the mean molecular weight and the viscosity.

This was repeated after the complete hydrogenation of each fraction of polymer.

The polymer fractions had the following properties : the density of both polymer fractions is a linear function of the temperature between 20° and 80° C. ; the viscosity and the molecular weight follow Dunstan's equation $\log \eta = A + Bm$ at 20°, 40° and 60° C. However, at 80° C. a small deviation was observed.

Before hydrogenation the viscosity values are relatively high for the *iso*butene polymers.

The influence of the temperature on the viscosity increases with increasing molecular weight.

The structure of the raw material for the polymerization reaction has practically no influence on the viscosity–temperature relation.

The relation between $\log \phi$ and $1/T$ is practically linear for the lower molecular weights ; in the fractions with higher molecular weight there is a deviation.

P. C. K.

1207. Determination of Mercaptans in Hydrocarbon Solvents. W. M. Malisoff and C. E. Anding, Jr. *Ind. Eng. Chem., Anal.*, 1935, **7**, 86–88.—Describes an improvement of the silver nitrate method of Borgstrom and Reid for the determination of mercaptans. *n*-Amyl, *iso*amyl, *n*-butyl, *iso*butyl, *n*-propyl, *n*-heptyl, benzyl, phenyl and *p*-tolyl mercaptans in the solvents, heptane, octane, benzene, and naphtha were tested by the following procedure. To weighed amounts of mercaptan solutions kept in the dark for as short a period as possible in glass stoppered Erlenmeyer flasks add 5–10 ml. methanol and an excess of standard 0·005*N*-silver nitrate. Shake well and add 2 ml. standard ferric alum indicator. Titrate with 0·005*N*-ammonium thiocyanate to a very faint pink. Then add a small excess of silver nitrate and titrate back with thiocyanate until the pink appears. The final result is taken as the end-point. Constant shaking is necessary throughout, and care must be taken not to confuse the faint colour of the end-point with the slight tint due to the ferric alum. The effect of light exposure, concentration of mercaptans, emulsion breaking and masking of the end-point on the results are given, together with some duplicate analyses of commercial naphthas. G. R. N.

1208. Analysis of Mixtures of the Monochlorides of *n*-Pentane and *iso*Pentane. H. B. Hass and P. Weber. *Ind. Eng. Chem., Anal.*, 1935, **7**, 231–233.—A new method has been developed for analysing mixtures of two isomeric alkyl chlorides the boiling points, refractive indices and densities of which are too close to each other to serve as the basis for analytical methods. This method is based on the difference in the reaction rate constants of the alkyl chlorides with potassium iodide dissolved in anhydrous acetone. It was also found that the anilide method of Lauer and Stodola for analysis of alkyl bromide mixtures was applicable without modification to these alkyl chlorides. G. R. N.

1209. Aviation Gasolines Specifications. E. L. Bass. *Oil & Gas J.*, 20.6.35, **34** (5), 15.—Representative British, French and American aviation gasoline specifications are tabulated. Most specifications demand a max. V.P. Reid at 100° F. of 7 lb., and there should be no difficulty in designing fuel systems giving freedom from vapour lock under all conditions with fuels meeting this requirement. Essential factors in the design of fuel systems to avoid vapour lock are mentioned. A max. freezing point of — 50° C. provides adequate safety margin against the danger of obstruction of flow of fuel to the engine due to freezing. This limits the use of benzole as blending medium for petroleum fuels to 20%, although toluene can be used in greater proportions. Alcohol mixtures are considered by most authorities to be unsuitable, on account of liability to separation in the presence of water and of lower calorific value. Variations in sp. gr. between the range 0·710 and 0·765 produce an insignificant variation in fuel flow with modern carburettors with submerged jets. Viscosities of gasolines range from 0·40 to 0·50 cp. at 40° C., and carburettors should be designed so that the coefficient of discharge is independent of fuel viscosity, since variations in service due to change of temperature are greater than those of different basic gasolines.

With normal care it is possible to deliver virtually water-free gasoline to aircraft. Usually gum tests are necessary only when benzole, cracked or coal spirit products are included in the fuel.

It is essential that free sulphur should be completely absent, but total sulphur contents of up to 0·15% are permitted in various specifications. This limit is approached only when benzole and coal spirits are employed. There is some evidence that high sulphur content leads to corrosion of sparking plug electrodes, but this can be overcome by use of suitable electrode material. Corrosion of working parts due to sulphur is most unlikely. The acid heat test was devised in America to exclude cracked gasolines, benzole and alcohol, which were thought to be over-rated by the C.F.R. Motor Method.

With the increased demand for high octane-rating fuels, it is probable that cracked gasolines will be utilized in the future. With improved methods of manufacture it is probable that such fuels can be made to meet all requirements of the aviation industry, but revision of many specifications in force at present will be necessary.

The quantity of *iso*-octane likely to be available is such that its use as a blending agent only is probable, and T.E.L. will be used still further to increase the octane rating of such blends. The exact determination of octane ratings in the region of 100 is difficult, and no evidence is available as regards correlation between the C.F.R.

and full-scale engines. The quantity of *iso*-octane which can be blended with aviation gasoline and still meet existing boiling-point specifications is limited. This will probably be overcome by change in specification, or more probably by alterations in engine starting systems to compensate for decreased volatility at lower temperatures of the blends. R. A. E.

1210. Analysis of Complex Gaseous Mixtures. J. W. Lang. *Ind. Eng. Chem., Anal.*, 1935, **7**, 150–152.—In the course of a study of the pyrolysis of propane it was necessary to make quantitative determinations of nitrogen, oxygen, hydrogen, carbon monoxide, carbon dioxide, methane, ethane, ethylene, propylene and propane in a mixture, which might contain any or all of these components. Standard procedures had to be modified, and a combination of the Podbielniak distillation column and the Shepherd gas analysis apparatus was found suitable. The gaseous mixture was cut into three fractions by the column. The first fraction was cut on the ethylene plateau of the distillation curve, the second was made on the break between ethane and propylene and the third was made to include propane. Each fraction was analysed in the Shepherd unit by absorption and combustion. The preferred absorbent for the olefins was bromine water saturated with sodium chloride. Details of the procedures are given, together with the method of determining the correction factor for the Shepherd unit. G. R. N.

1211. Analysis of Combustibles in Flue Gas. R. N. Evans and J. E. Davenport. *Ind. Eng. Chem., Anal.*, 1935, **7** (3), 174–178.—A laboratory procedure for flue gas analysis, designed to estimate the loss due to incomplete combustion, is described, including a comparison of the results of field and laboratory procedures of flue gas analysis from an efficiency test on a steam generating unit. A laboratory apparatus is also described which, employing a synthetic flue gas, is capable of measuring this loss directly. G. R. N.

1212. Moisture in Natural Gas. E. G. Hammerschmidt. *Petr. World*, 1935, **32** (419), 216–218.—Discusses the possible contributory sources of the moisture in natural gas as it is transported from the well to the place of consumption under the titles, solidification, clogging of the line, recompression, absorption plants and compression and cooling. With regard to solidification, it is stated that under certain conditions solid gas hydrates are formed resembling snow in appearance. One property of these hydrates is that the melting point increases with pressure, and for a Texas Panhandle "dry" gas the relationship was melting point (° F.) = 8·9 × absolute pressure 0·285 (lb./sq. in.), so that at 800 lb. pressure the melting point was about 60° F. The various solid and liquid drying agents, together with the Klaiber and Sperr processes of dehumidifying gas, are briefly described. G. R. N.

1213. Recent Aviation Fuel. E. Endo and H. Furuya. *J. Fuel Soc. Japan*, 1935, **14**, 35–38.—Measurements of octane values (C.F.R. Motor Method) of Japanese aviation and cracked gasolines with and without lead tetra-ethyl, motor benzole, and pure alcohol were carried out. They indicated it was better to use an ethylized fuel than those blended with benzole or alcohol when the mixture temperature was high, as in the case of the summer season, or when employing a supercharger. The authors were of the opinion that 100 octane number will be required for aviation fuels in the near future, but it will be the upper limit of practical use, because if the compression ratio of the engine were greatly increased, troubles such as the dissociation of carbon dioxide and an increase of engine weight will occur, on the one hand, and the increasing rate of thermal efficiency is rather small at such a high compression ratio, on the other. They also emphasize that lead tetra-ethyl should be improved in stability and its corrosive tendency decreased. G. R. N.

1214. Standardized Test of Gasoline Colour Stability. C. D. Lowry, Jr., M. A. Smith and G. B. Murphy. *Ind. Eng. Chem., Anal.*, 1935, **7**, 140–143.—To test the colour stability of gasoline the light should be of unvarying intensity and of sufficiently high intensity so that the time taken for the test would be short. A suitable source of light was found in a carbon arc lamp 60 volt–50 amp. A.C. with two upper carbons 22 mm. diam. and two lower ones, 13 mm. diam. The two pairs of carbons burned alternately, the arc shifting from one to the other at 20–30 minute intervals. This was changed so that all the samples ranged around the lamp in slots inside the housing should

receive the same illumination. One pair of carbons was removed and the other pair placed centrally to the frame. The slots were water-jacketed, and each sample was exactly 12 in. from the arc. "Sunshine" carbon containing cerium was used, and it had a practically continuous spectrum from 2800 Å. through the longer wavelengths. The apparatus was standardized by comparison with sun exposed gasolines. The intensity of the sunlight was followed by oxalic acid–uranyl acetate tests to ensure variations in intensity were small. Bottles of glass, Corex D and quartz were used. Experiments indicated that exposures to the arc of 40, 25 or 15 minutes, respectively, for these three glasses was equivalent to two hours' sunlight. G. R. N.

1215. Rapid Volumetric Estimation of Gum in Gasoline. P. Woog, J. Givaudon and A. Chmelevsky. *Rev. Petr.*, 15.6.35, **635**, 757.—The gravimetric method for determination of existent gum proposed by the authors takes 24 hours, so attempts to shorten this time led to the following method, which takes 75 minutes. 100 mls. of the gasoline to be tested were transferred to an Engler flask fitted with a 30-cm. Vigreaux condenser. The flask was immersed in an oil bath at 160° C. and the distillate collected in a receiver. After 15 minutes the receiver was removed, the free end of the condenser was connected to a water pump and the pressure slowly reduced to 30–50 mm. mercury. When the distillation had finished, the flask was retained in the oil bath until the gum left in the bottom was dry. The total operation took 40 minutes. The pellet of gum was then dissolved in 15 mls. carbon tetrachloride, and 15 mls. 20% sulphuric acid and 20 mls. *N*/10-potassium permanganate were added. The mixture was heated to boiling with agitation for 3 minutes. 2 mls. 25% potassium iodide solution, 10 mls. *N*/10-sodium thiosulphate and 1 ml. starch solution were added and the mixture was agitated. If a blue coloration was obtained, the gasoline contained 10 mgm./100 mls. gum or less. If no blue colour was produced, then the existent gum was more than 10 mgm./100 mls. This method was based on the authors' systematic investigations, which showed that 1 ml. *N*/10-potassium permanganate was reduced by 1 mgm. gum. G. R. N.

1216. Precipitation of Asphaltic Sludge from Aged Mineral Oils by Petroleum Spirit. A. Maillard and A. Acker. *Ann. des Comb. Liq.*, 1935, **10**, 465–472.—The amount of sludge precipitated from aged mineral oils by means of petroleum spirit increases slightly with the time of contact, particularly if the solution is stored in the light. The presence of oleic acid causes an increased solubility of the sludge, giving a lower value for precipitated asphalt. Stearic acid, on the other hand, has no similar effect. If the atmosphere above the solution is saturated with water, or if water is dissolved in the spirit, the proportion of sludge is appreciably increased. If the precipitation and filtration occur at low temperatures (*e.g.* 0° C.), the sludge is higher than when the experiment is carried out at room temperature. Presence of vapours of acetone decreases the proportion of sludge, but alcohol, sulphur dioxide, hydrochloric acid and ammonia all increase the amount of sludge formed, the latter gas by chemical reaction with the acid constituents forming insoluble compounds. Carbon dioxide has no action. Since contamination of the atmosphere may have marked influence on the amount of sludge precipitated, it is essential that stoppered bottles be used, and that precipitations shall always take place at the same temperature and in the dark. The water content of the spirit must also be controlled. C. C.

1217. Effects of Carbon Suspension on Some Properties of a Lubricating Oil. H. H. Smith. *Instruments*, 1935, **8** (7).—A viscometer with interchangeable tubes has been designed for determining the absolute viscosity of oils. Arrangements are made by means of which the number of drops falling from the jet may be counted by means of a photo-electric cell. The instrument may therefore be used to determine the surface tension of the oil as well as its viscosity, or, alternatively, if it is assumed that all oils have the same surface tension at the same temperature, the number of drops may be used to estimate the efflux from the instrument.

The results of test on a series of suspensions of carbon black in lubricating oil by this instrument are given. P. D.

1218. Character and Quality of Russian Lubricating Oils. E. W. Steinitz. *Petr. Zeit.*, 7.8.35, **31** (32), 6–8.—The oils from the chief producing oilfields of Russia are described—namely, Baku, Surachany, Balachany and Bibi-Gibat. The content of paraffins is 1%, asphaltenes 0·52% and neutral resins is 6·4%; the set point of the

300–400° fraction after removal of aromatic hydrocarbons is below — 80° and that of the 400–500° fraction after similar treatment is below — 40°. The qualities of these oils are enumerated, the high naphthene content rendering them stable to oxygen and to cold and yielding a low residue which is never resinous to metal surfaces.
W. S. E. C.

1219. Russian Lubricating Oils, their Production and Qualities. G. Alexijew. *Petr. Zeit.*, 7.8.35, **31** (32), 8.—The advances made in the production of Russian lubricating oils are described at length. In Baku, Grosny and Batum vacuum tube stills are used for their manufacture, and refining is carried out by contact filter processes using bleachers.
W. S. E. C.

1220. A Reproducible Process for Exact Photomicrographic Reproduction of Dispersions, with Particular Reference to the Examination of Bituminous Emulsions for Road Work. Ib. Hvidberg. *Koll.-Z.*, 1935, **72**, 274–279.—The range of size of particles which it is necessary to photograph gives rise to difficulties with depth of focus. The author has found means of overcoming these difficulties.

The Brownian movement of the finer particles is brought to a standstill by setting the emulsion specimen in a solution of gelatine containing soap to avoid coagulation. The specimen is prepared in a counting chamber of depth 20 μ, so that this is the maximum depth of the specimen, and no particles need be deformed by pressure of the cover slip. The necessary resolving power and depth of focus are best secured by using a 10 X objective, and a 0·17 Zeiss eyepiece. A 200 X linear magnification is adopted; the exposure being made on a 9 × 12 cm. plate, and including 5000–10,000 particles.

One gram of emulsion is diluted with 50 c.c. of gelatine-soap solution, the diluting liquid being maintained at about 40° C. A few drops of the dilute emulsion are introduced into the haemacytometer chamber, and allowed to set. The photographic exposure is made with a green filter, consisting of a 5-cm. thickness of a 0·006% solution of naphthol green.

When the system adopted for routine purposes is not sufficiently accurate for special research work, a further elaboration of the former method may be employed. The smaller particles suffer from defraction effects, which render the measurement of their true size rather difficult.

The new method avoids this difficulty by using dark ground illumination. A Zeiss–Epicondenser with an objective specially designed for it is employed. A yellow filter gave the best results in this case. The exposures are made at different depths of the specimen, the light emitted by particles at other depths being insufficient to affect the plate, if the correct exposure is chosen. The layers on which exposures were made were 2 μ apart. This procedure gives sharp images of all the particles in the specimen, irrespective of depth.
L. G. G.

Class 600. Refining and Refineries.

1221. Continuous Coking on Dubbs Units. L. F. K. Van Dongen and W. A. Keightley. *Petr. Times*, 1935, **34**, 75.—Since March 1933 the Dubbs Units at the Astra Romana refinery have been running in continuous operation. This continuity is accomplished by arranging reaction chambers in pairs, in parallel. The charge is flashed to the usual residuum under high pressure in one vessel, the residue being then coked under low pressure while high-pressure operation is continued in the second chamber, and vice versa. The control of the heat required for coking is usually obtained by means of hot refractory oil, which is injected into the low-pressure reaction chamber. Such an arrangement makes for increased capacity and lower operating costs. There appears to be no sensible difference in the properties of the products nor of the yields as produced by this continuous process and the more usual batch process.
H. G.

1222. Effect of Pressure in Cracking. M. S. Nemtzov. *J.I.P.T.*, 1935, **21**, 644–653.—The effect of pressure in cracking is discussed in the light of data from published literature, as well as of the investigations of the Government High-Pressure Institute, Petrograd.
G. R. N.

1223. Refining of a Cracked Motor Spirit. D. G. Jones. *J.I.P.T.*, 1935, **21**, 709–724.—An account of the vapour phase refining of an Argentine cracked spirit ex a Cross

unit giving details of the manufacture of the clay, its laboratory evaluation, and of the operation of the cracking unit, Gray towers and treating plant. G. R. N.

1224. Hydrogenation of Japanese Coals. S. Uchida. *J. Fuel Soc. Japan*, 1935, **14**, 38–44.—An abridged abstract of published investigations on the hydrogenation of Japanese coals commenced in 1921 dealing with the general experimental procedure, the effects of initial pressure, reaction temperature, reaction time, catalyst, purity of hydrogen, fineness of coal and the vehicle. Analyses of hydrogenated oils from various coals are also given. G. R. N.

1225. Hydrogenation of Coal. E. Moehrle. *Angew. Chem.*, 1935, 509–513.—In a discussion of recent views and work connected with extraction, distillation and hydrogenation of coal, the author considers that the most successful method would be a combination of distillation and hydrogenation. Fine coal of low value would be converted into a valuable solid fuel and a primary tar which could be topped and then hydrogenated into benzine and middle oils. L. S.

1226. Removal of Thiophen from Benzene by the Action of Acidified Hypochlorite Solutions. E. G. R. Ardagh and W. H. Bowman. *J.S.C.I.*, 1935, **54**, 267T–268T.—Sodium hypochlorite does not attack thiophen, but the latter is attacked by hypochlorous acid. Experiments have been carried out on the removal of thiophen from benzene by treatment with aqueous calcium hypochlorite acidified with acetic acid. For complete removal of thiophen from benzene, the initial acidity of the acid solution should correspond to pH 3·9–4·0. C. C.

1227. Graphical Correlation of Solvent Extraction Data. S. S. Kurtz. *Ind. Eng. Chem.*, 1935, **27**, 845.—A method of plotting solvent extraction data for petroleum hydrocarbon mixtures is described, for which the advantages are claimed that rectangular co-ordinate paper may be used, and that it is not necessary to define the components of the extracted hydrocarbons.

The X axis of the graph is graduated in terms of some physical such as density, refractive index or viscosity–gravity–constant, which is additive on a volume per cent. basis (viscosity–gravity–constant is employed in the example given). The Y axis is graduated in volume per cent. of solvent (0–100%), and a point called the solvent apex is arbitrarily located on the 100% solvent line. The further construction follows the general procedure for triangular graphs, but in a simplified form. F. E. A. T.

1228. Liquid–Liquid Extraction Systems. T. G. Hunter and A. W. Nash. *Ind. Eng. Chem.*, 1935, **27**, 836.—Laboratory extraction methods for liquid–liquid systems are discussed in considerable detail, and flow diagrams are used to illustrate—

(1) Multiple contact extraction.
(2) Multiple fractional distribution for separation of two-component mixtures.
(3) Pseudo counter-current extraction.

The practical imitations of these systems are examined, and mathematical expressions given for certain cases where the distribution law applies.

Equilibria in complex hydrocarbon–solvent systems are reviewed with the aid of triangular graphs, and experimental results for the nitrobenzene extraction of various stocks in the Atlantic Refining Co.'s laboratories are used to derive actual equilibria curves, and to illustrate the use of these curves in predicting the results of counter-current operation.

Mixer efficiency is considered, and is shown to vary with solvent treatment for air agitation in laboratory glass vessels. An illustrative set of curves shows the relationship between the number of ideal extraction stages and the solvent–oil ratios for various quality (viscosity–gravity–constant) raffinates derived from the same stock. F. E. A. T.

1229. Safety in Natural Gasoline Operations. N. C. Wells. *Petr. World* (LA), 1935, **32** (5), 58.—Location, lay-out, care and operation of gasoline plants, in relation to the matter of safety, are dealt with, particularly in regard to boilers, safety relief valves, liquid level alarms, pipes and fittings, storage tanks and operating personnel. Methods of testing plant details and correct procedure for safe operation illustrated and described. W. W.

1230. New Gasoline Plant Residue Test. R. N. Donaldson. *Petr. World* (LA), 1935, **32** (3), 27.—Describes a method for determining total pentane and heavier losses in

gasoline plant dry gases, which consists of absorbing the heavier constituents of the gas in a solvent composed mainly of butanes, and then carrying out a controlled weathering of the combined condensates, without fractionation, to plus 34° F.
W. W.

1231. Production of Gasoline by Polymerization of Olefines. C. R. Wagner. *Ind. Eng. Chem.*, 1935, **27**, 933.—Semi-works scale tests on the non-catalytic thermal polymerization of cracked gases are described in detail, on the results of which a commercial unit to handle 5 million cu. ft. of gas per day was constructed. Cracked gases containing 20–24% of ethylene, 13–18% of propylene and 6–10% of butylene gave up to 1·7 gallons of polymer gasoline per 1000 cu. ft. by non-recycle operation at 950° F. and 800 lb. pressure and up to 3·0–3·25 gallons per 1000 cu. ft. by recycle operation. Reflux liquids containing about 80% of olefines yielded about 9 gallons of gasoline per 1000 cu. ft. The gasolines have octane numbers (Motor Method) of about 78 when produced under optimum conditions. Data are given to show that increase in operating pressure increases both the speed of the polymerization reactions and the yield of product, whilst an increase in temperature causes a marked increase in the speed of the reaction, has a pronounced effect on the amount of coke produced, and materially affects the quality of the liquid product.

By the rapid heating of olefine gases to 1100° F. or higher, and then allowing the temperature to rise to 1200–1300° F. by virtue of the exothermic heat of reaction, it is possible to produce highly aromatic gasolines of approximately 100 octane number, from which benzene, toluene and the xylenes may be isolated in substantially pure condition.
D. A. H.

1232. Benzine Synthesis. H. Pichler. *Z. Ver. d. Ing.*, 1935, 883.—Deals with the benzine synthesis of Fischer–Tropsch at 200° C. and atm. pressure. One cu. m. of gas containing 30% C and 60% H_2 yields a maximum of 120 g. of liquid, water-white, sulphur-free hydrocarbons. The various products are described.
L. S.

1233. Manufacture of Paraffin Wax. R. Fussteig. *Chim. et Ind.*, 1935, **33**, 289.—The author, following methods of preparation analogous to those of Zalosiesky, states that: (1) the paraffin wax produced is well crystallized; its solutions are not of the colloidal type; (2) the crystal form of the separated wax depends on the properties of the solvent used; sometimes hexagonal lamels occur which can be transformed into needles. This transformation is not reversible; (3) paraffin wax with low m. p. is more soluble than the higher-melting products derived from the same crude oil; it also has a smaller crystallization velocity.

Wax-bearing oils containing both lower- and higher-melting paraffins show complicated crystallization and recrystallization phenomena.

By splitting it up into two fractions of different specific gravity separate crystallization produces most satisfactory products.

Every uncrystallizable paraffin oil contains two kinds of compounds, which hinder normal crystallization. (*a*) Those of a resinous origin; if removed *e.g.* by the action of sulphuric acid a crystallization in lamel crystals is observed. (*b*) Those of a viscous type removable by special processes only.

It is shown that a pretreatment of a wax-bearing oil in gasoline solutions with an activated earth is better deparaffined without a sulphuric acid treatment than after a treatment with 5% concentrated acid; in the first case a more rapid filtration was possible, producing a product with a lower crystallization point.

A scheme of a new manufacturing process is given, which is mainly based on splitting up a wax-bearing oil in three fractions, which are handled separately according to the above-mentioned investigations.

The first fraction, being liquid, is directly cooled down and pressed off, producing acicular crystals. To the second, semi-viscous, containing the lamel crystals form mainly, a small quantity of phenol is added; by this manipulation the lamels are transformed into the preferred needles.

To the third an equal volume of gasoline is added and this blend is cooled down after a treatment with activated earth; the paraffin wax is pressed off. The filtrate meets all requirements of a good cylinder oil.
P. C. K.

1234. Improving Polish Asphalt (from Crude Oil) for Road Construction. R. Fussteig. *Asphalt u. Teer*, 1935, **35**, 627–629.—The quality of the asphaltic bitumen prepared by

distillation of crude oil is affected by variations in the distillation process, and particularly by the presence of free carbon. When the latter is present in the colloidal state it has no deleterious action, but if suspended carbon is present, due *e.g.* to overheating, the product is inferior. It is stated that asphalt prepared from asphaltic base crude by a shell still has a higher softening point than that prepared in a pipe still, but the quality of the asphalt is actually poorer. This is mainly due to low asphaltene and resin contents and high hard asphalt and coke. With paraffin base oils, however, straight distillation without cracking leaves a residue containing oil, asphalt, coke and solid paraffin. The latter is particularly disadvantageous if the resin and asphaltene contents are low. Satisfactory asphalts can be obtained from such oils, however, by first cracking the oil (but not so completely as to form coke). Alternatively, suitable asphalts can be obtained by blowing with air. Light constituents are first removed in a fractionating column followed by treatment with superheated steam. The residue is blown with air, giving a product of high softening point and low penetration.

C. C.

1235. Corrosion of Steel. T. J. Finnegan, R. C. Corey and D. D. Jacobus. *Ind. Eng. Chem.*, 1935, **27**, 774.—The corrosive effects of oxygen and carbon dioxide on steel have been studied, specimens of the metal being exposed to various known concentrations of the gases in a stream of non-turbulent water (2·5 cm./min. at 60° F.).

The corrosive rate was found to be a function of the carbon dioxide and oxygen concentrations, one part of the latter being as corrosive as 20 parts of the former. At constant oxygen content, the corrosion rate varied linearly with the amount of free carbon dioxide in solution, while, with a constant carbon dioxide content, the corrosion rate varied linearly with the oxygen concentration, except when the latter was below 0·5 part per million. The relationships are shown by means of curves. W. H. T.

1236. Patents on Refinery Plant. P. J. Wiezevich. U.S.P. 2,007,117, 2.7.35. A sectional fractionating column.

J. V. Meigs. U.S.P. 2,007,656, 9.7.35. Distillation of tar by the sensible heat in the blow gases from a water gas set.

T. S. Cooke. U.S.P. 2,008,578, 16.7.35. Distillation of pressure distillate using naphtha vapours in the place of steam.

M. J. Burkhard. U.S.P. 2,009,079, 23.7.35. Distillation apparatus for the production of intermediate fractions of controlled initial vaporization point.

L. A. Mekler. U.S.P. 2,009,092, 23.7.35. A cracking-furnace construction in which the heat supplied to the radiant-heat tubes, the convection bank or the soaking bank may be independently controlled.

J. F. Wait. U.S.P. 2,009,366, 23.7.35. A process for freeing oil from mineral and carbonaceous matter. The oil is extracted from the mineral matter, contacted with adsorbent and separated into light and heavy components.

W. Mendius. U.S.P. 2,009,557, 30.7.35. Distillation apparatus comprising shell still and column, a heat exchanger being fitted inside the still. The charge is passed through the heat exchanger, then to the column and finally to the shell still.

J. D. Brady. U.S.P. 2,009,646, 30.7.35. A combined high-pressure separator and dehydrator for the treatment of petroleum emulsions.

G. L. Mateer. U.S.P. 2,009,711, 30.7.35. Apparatus for automatically varying the flow of liquid in accordance with variations in the specific gravity of gas flowing through a conduit.

D. J. Bergmann. U.S.P. 2,011,030, 13.8.35. Apparatus for two-stage fractionation in which the low-boiling condensate formed in the secondary zone is reboiled by indirect contact and heat exchange with a regulated quantity of higher-boiling condensate from the primary zone. The latter is thereby cooled, the cooled condensate being returned to the primary zone. W. H. T.

1237. Patents on Cracking. G. Zotos. E.P. 432,736, 1.8.35. Oil is cracked by treatment with superheated gases, being fed through a reaction chamber and over the cooled surfaces of a heat exchanger contained therein. The temperature of the reaction is controlled by feeding the materials to be superheated through the heat exchanger.

J. S. Gallagher. U.S.P. 2,006,449, 2.7.35. A cracking still fitted with a cylindrical inner shell so that a narrow annular passage-way is formed between the shell and the

walls of the still. A propeller is mounted within the inner shell, and circulates the oil so as to give turbulent flow in the annular passage-way.

J. B. Heid. U.S.P. 2,006,552, 2.7.35. A process in which oil is subjected to mild conversion conditions, after which the total liquid and gaseous products are cracked under more severe conditions. The reflux from the fractionation of the final product is returned to the second stage.

G. C. Hargrove. U.S.P. 2,006,571, 2.7.35. Cracking stock is preheated by means of coils placed in the paths of cracked vapours in the dephlegmator and evaporator. The heated stock is then mixed with the liquid products from dephlegmator and evaporator prior to being passed to the cracking coil.

R. K. Stratford. U.S.P. 2,007,114, 2.7.35. Oil is solvent-refined, using cresol, prior to being cracked.

D. W. Hoge. U.S.P. 2,007,532, 9.7.35. Cracking apparatus with molten metal as the heat-transmitting medium. The conduit pipe through which the cracked vapours pass is constructed of catalytic material.

C. B. Forward. U.S.P. 2,007,081, 2.7.35. Vapour-phase cracking with controlled heating to give a distillate boiling below 450° F., and having the boiling-point curve of straight-run spirit and with an aromatic content in excess of 50%.

C. W. Watson and V. Stapleton. U.S.P. 2,008,480, 16.7.35. A combined cracking and coking process.

J. B. Heid. U.S.P. 2,008,502, 16.7.35. Charging stock is mixed with reflux condensate, part of the mixture is cracked in the vapour phase and part in the liquid phase. The products of both operations are blended and distilled.

R. A. Halloran. U.S.P. 2,008,550, 16.7.35. A cracking process in which the reflux condensate, resulting from the dephlegmation of the cracked products, is digested under the plant pressure in a heat-insulated zone at cracking temperature without further application of heat. The reflux is then separated into vapour and residue and the latter recycled to the cracking operation.

H. V. Atwell. U.S.P. 2,008,661, 23.7.35. Charging stock is separated into a distillate and a residue cracking stock, each material being then cracked under suitable conditions. The products are mixed and digested and then separated into vapour and residue, which are again soaked prior to final removal of vaporizable components.

G. Egloff. U.S.P. 2,009,108, 23.7.35. Cracked distillate is improved with regard to yield and quality by adding to the distillate an aromatic hydrocarbon boiling within the gasoline range. The aromatic compound reacts with olefines in the distillate to form alkylate derivatives boiling within the motor-spirit boiling range.

E. F. Nelson. U.S.P. 2,009,119, 23.7.35. Cracking of casing-head gasoline, in which the cracked products are fractionated into three fractions. The intermediate fraction is blended with the cracking stock and the mixture recycled, whilst the light and heavy fractions are blended to form the desired product.

J. G. Alther. U.S.P. 2,009,128, 23.7.35. A process in which the light products of cracking are subjected to the refining and cleansing action of steam in order to obtain a product of good colour, odour and stability direct from the cracking system.

C. H. Angell. U.S.P. 2,009,129, 23.7.35. A combined topping and cracking unit, waste heat from the cracking operation being used as a means for topping the crude oil. The straight-run gasoline is blended with a cracked product of similar boiling range resulting from cracking heavier components of the crude.

H. E. Wilson. U.S.P. 2,009,367, 23.7.35. A process in which oil is subjected to cracking conditions for a predetermined period of time and is then subjected to successive pressure-reducing stages under controlled conditions.

C. P. Dubbs. U.S.P. 2,009,878, 30.7.35. A cracking plant so designed as to be capable of dealing with two cracking stocks of different origins.

A. Fisher. U.S.P. 2,010,357, 6.8.35. Pyro-bitumen is mixed with an emulsion of water and oil containing zinc chloride and an emulsifying agent, and the product decomposed by heating to yield low-boiling hydrocarbons.

J. C. Morrell. U.S.P. 2,010,369 and 2,010,370, 6.8.35. A process and apparatus for the conversion of relatively light oil and simultaneously subjecting a heavier oil to milder conversion conditions in the same cracking system. Insufficiently cracked intermediate products are separated into light and heavy fractions, the former being recycled with the light cracking stock and the latter cracked with the heavy stock.

R. Pyzel. U.S.P. 2,010,376, 6.8.35. Oil is converted by means of hot combustion gases, the latter being cooled to the desired temperature by admixture with steam.

J. H. Forrester. U.S.P. 2,011,479, 13.8.35. Vapour-phase cracking in which the oil in the reaction chambers is kept at a minimum in order to avoid excessive coke formation. W. H. T.

I.G. Farbenind. A.-G. D.R.P. 612,684, 3.7.30. For the treatment (cracking, polymerization, etc.) of organic substances an apparatus of refractory material is used. The parts coming into contact with hot C-containing substances are coated with crome oxides to prevent carbon deposition.

F. Bornemann and P. Weicksel. D.R.P. 616,222, 29.8.31. Oil is first injected against a baffle, and then caused to ascend through a layer of molten metal. L. S.

1238. Patents on Hydrogenation. H. D. Elkington. E.P. 402,264, 30.11.33 (Amended). Hydrogenation is carried out in a system of vertical alternate wide and narrow tubes connected in series. In order to avoid coke formation, the reaction material flows downwardly in the wide tubes and upwards in the narrow tubes.

Int. Hydn. Pats. Co. E.P. 431,435, 8.7.35. Catalytic hydrogenation in which the catalyst is distributed in the initial material in the presence of water so that a homogeneous paste is made. The water is removed before hydrogenation takes place.

Int. Hydn. Pats. Co. E.P. 431,795, 16.7.35. A two-stage hydrogenation process, the first stage being in the liquid phase and the second in the vapour phase. The gases and vapours from the first stage are passed to the second without intermediate condensation.

Int. Hydn. Pats. Co. E.P. 431,970, 18.7.35. A hydrogenation process in which "foreign" gases are removed from the hydrogen-containing gases by low-temperature scrubbing with liquefied gaseous hydrocarbons. Hydrocarbons introduced into the gas by the scrubbing treatment are removed with the aid of washing oils.

I.G. Farbenind. A.-G. E.P. 432,638, 25.7.35. Hydrogenation of carbonaceous materials, finely-divided catalysts and/or surface active materials being suspended in the raw stock in the liquid phase and the mixture then passed through a preheater and one or more reaction chambers. Part of the mixture is returned to the preheater from a settling vessel in order to concentrate the catalyst and to prevent deposition of carbon, etc., on the heating tubes.

C. Krauch. U.S.P. 2,006,996, 2.7.35. Hydrogenation of carbonaceous materials at 300–700° C. and at least 20 atm., in the presence of a catalyst consisting of a solid mixture of heavy metal sulphide with a substance selected from zinc oxide, zinc carbonate, alumina, magnesia calcium carbonate and magnesium carbonate.

A. Szayna. U.S.P. 2,007,226, 9.7.35. Non-catalytic hydrogenation in which the hydrogen–oil mixture is heated and passed into a substantial body of the mixture kept at below cracking temperature, dispersion of hydrogen in the oil being maintained. The mixture is then heated to cracking temperature at above 50 atm.

E. B. Peck. U.S.P. 2,009,717, 30.7.35. High boiling oil is hydrogenated at 750–950° F. and above 50 atm., the vapours evolved being treated with additional hydrogen at a higher temperature. The final product is fractionated, the reflux is cracked and the cracked products are fractionated. Reflux from the latter is introduced into the vapours from the first hydrogen treatment.

C. P. Dubbs. U.S.P. 2,010,982, 13.8.35. Oil is cracked and the product separated into motor spirit, uncondensable gas and unvaporized residue, the last two products being mixed and hydrogenated to yield a further quantity of motor spirit.

M. J. Lockhart. U.S.P. 2,011,109, 13.8.35. Vaporized oil is heated and passed to a mixing chamber, where it comes into contact with hydrogen which is generated by passing steam through a molten metal bath. The mixture of hydrocarbon vapour and hydrogen is finally passed through a condenser.

T. W. Pfirrmann. U.S.P. 2,012,318, 27.8.35. Solid and liquid carbonaceous materials are treated by being heated in a closed container with water and a metal under such conditions that the water is decomposed by the metal to form hydrogen. The metal employed is zinc powder, and after use and oxidation it is treated with reducing gas and then returned to the process. W. H. T.

I.G. Farbenind. A.-G. D.R.P. 614,916, 27.6.26. Low-boiling hydrocarbons are produced by destructive pressure hydrogenation in the presence of catalysts at high temperatures and pressures. On treating fractions of medium boiling range from the

pressure hydrogenation, in the presence of sulphur-resisting catalysts in the vapour phase, hydrogenation as well as cracking is effected.

W. Rittmeister. D.R.P. 615,397, 7.5.31. Low-boiling hydrocarbons are produced by hydrogenation in vertical paired tubes in series, alternately wide and narrow. In the wide tubes the mixture flows downward and inversely in the narrow tubes.

L. S.

1239. Patents on Gas. P. Feiler and H. Haeuber. U.S.P. 2,007,754, 9.7.35. Conversion of gaseous hydrocarbons into those of lower hydrogen to carbon ratio by heat treatment at 400–1300° C. in the presence of coke formed in the dry distillation of coal.

R. H. Price. U.S.P. 2,008,468, 16.7.35. A process of producing motor fuel from gaseous hydrocarbons. The latter are heated under pressure to effect conversion to liquid low-boiling benzenoid hydrocarbons. The product is cooled, and the low-boiling components are removed by scrubbing with a heavy absorbent oil which is subsequently distilled in a stream of hot cracked vapours to vaporize the low-boiling hydrocarbons and a major proportion of the absorbent oil. The vapours are dephlegmated in order to obtain a clean charging stock for cracking purposes, the vapour products of which are used for the distillation of the used absorbent oil.

W. H. T.

Bat. Petm. Mij. D.R.P. 613,121, 7.9.33. Olefines are chlorinated by atomizing in a stream of chlorine gas.

F. Waechter. D.R.P. 615,447, 17.2.29. Gas containing methane, ethylene, acetylene, or their homologues, are first treated by glow discharge and then heated to above 900° F. for a short time, higher hydrocarbons being produced. L. S.

1240. Patents on Crude Oil. R. T. Goodwin. U.S.P. 2,009,710, 30.7.35. A method of removing ash-forming components (*i.e.* salt) from crude oil. The latter is mixed with 25–40% of cracking coil tar and the mixture heated to 200–600° F. Sulphuric acid (½–1% of 30–60° Bé.) is then added, whereby a carbonaceous precipitate is formed, and carries with it the ash-forming components of the oil which may then be separated.

W. G. McMurray. U.S.P. Re. 19,666, 13.8.35. Apparatus for separating oil, gas and water by heat treatment. W. H. T.

1241. Patents on Motor Fuels. E. G. E. Meyer. E.P. 360,731 (Amended), 31.3.32. A motor fuel consisting of liquid hydrocarbon, together with small proportions of ether and of aldehyde in association with small amounts of a volatile basic material.

I.C.I. E.P. 403,406 (Amended), 13.12.34. A motor fuel comprising a blend of normal motor spirit and synthetic alcohol–oil mixture. The latter is obtained by passing a gas containing ethylene and propylene with or without higher olefines, mixed with steam, over a hydrating catalyst at an elevated temperature and pressure (200–350° C. and 50 atm. press.).

Du Pont. E.P. 432,121, 22.7.35. A gum-inhibiting and stabilizing agent for cracked motor fuels, benzole, diesel and transformer oils, etc., comprising one or more dihydroxynaphthalenes.

W. B. D. Penniman. U.S.P. 2,007,212, 9.7.35. Treatment of oils under pressure with air at 300–1000° F. The product is passed to a digesting zone, the air during the treatment being substantially deoxygenated.

G. Egloff. U.S.P. 2,009,879, 30.7.35. Refining cracked motor spirit in the vapour phase by treatment with an aqueous solution of zinc chloride in contact with hydrogen and under pressure.

J. C. Morrell. U.S.P. 2,009,898, 30.7.35. Vapour-phase refining in admixture with nitrogen oxide diluted with an inert gas, the mixture being passed through adsorbent earth.

R. C. Osterstrom. U.S.P. 2,009,902, 30.7.35. Gum-forming constituents of cracked distillates are removed by mixing the material with polymers treated with sulphuric acid and passing the mixture through a polymerizing zone under pressure. The product is distilled, the residue being contacted with sulphuric acid and re-used as the refining medium.

R. E. Burk. U.S.P. 2,009,954, 30.7.35. A desulphurizing process in which light distillates are mixed with aqueous caustic soda, the latter then being separated and mixed with a hydrocarbon solution of sulphur. The soda solution is next separated from the sulphur solution and again mixed with the distillate.

G. Egloff. U.S.P. 2,010,948, 13.8.35. Benzene hydrocarbons are alkylated to produce a mixture of alkylated derivatives boiling within and above the motor spirit range. The material boiling within the range is separated and the residue is dealkylated sufficiently to convert a substantial portion into motor fuel.

G. Egloff. U.S.P. 2,010,949, 13.8.35. Benzene hydrocarbons are reacted with gaseous olefines in the presence of sulphuric acid in order to produce alkylated derivatives suitable for motor fuel. Reflux condensate resulting from the distillation of the product is returned to the reaction zone.

D. W. Hoge. U.S.P. 2,011,556, 13.8.35. Gum formation in motor fuels is prevented by treatment of the fuel with alloys of copper aluminium and zinc with manganese, the latter being in the proportion of 50% of each of the metals.

C. F. Teichmann. U.S.P. 2,011,954, 20.8.35. A sweetening process in which oils are reacted with a suspension of lead sulphide in an alkaline solution containing inorganic peroxides. W. H. T.

C. P. Heylandt. D.R.P. 608,242, 12.4.30. Fuel gases for vehicles are obtained by the counter-current mixing of the combustible and oxygen, whereby the flow to the combustion chamber is delayed.

J. M. H. Classen. D.R.P. 615,651, 16.8.33. A motor fuel consisting of a solution of gaseous hydrocarbons (acetylene) in furfural or in a mixture of furfural with a solvent, *e.g.* acetone.

I.G. Farbenind. A.-G. D.R.P. 615,708, 15.6.33. A non-knocking motor fuel is produced by adding a metal organic substance (lead tetra-ethyl) and a small quantity of a water-soluble fluoride.

F. Seidenschnur. D.R.P. 616,102, 2.9.32. Coal benzines are desulphurized by treatment with H_2 or H_2-containing gases in the presence of alcoholic solutions of chlorides of Mo, Cr or W or their mixtures. L. S.

1242. Patents on Lubricating Oil. Standard Oil Dev. Co. E.P. 431,306, 4.7.35. Wax is separated from a waxy oil by diluting the latter with a solvent, adding not more than 4·5% of wax tailings and chilling the mixture to solidify wax which is then separated from the diluted oil.

Bat. Petm. Mij. E.P. 431,323, 4.7.35. Solvent-extraction of oils using a mixture of furfural and naphthalene as the solvent.

Sharples Speciality Co. E.P. 431,373, 5.7.35. Dewaxing oil by diluting, chilling and centrifuging. The diluent is a petroleum fraction boiling between 120° and 220° F.

Standard Oil Dev. Co. E.P. 431,434, 8.7.35. A high-pressure lubricant comprising mineral lubricating oil, free sulphur and an organic halogen compound (*i.e.* chlorinated paraffin wax).

Edeleanu Ges. E.P. 432,168, 22.7.35. A combined de-waxing and solvent extraction process using as the solvent, liquid sulphur dioxide (15–35 parts) mixed with liquid aromatic hydrocarbons (85–65 parts). For the solvent extraction, the concentration of liquid sulphur dioxide in the solvent is increased without separating the solvent from the de-waxed oil. W. H. T.

A. E. Pew, Jr. U.S.P. 2,006,407, 2.7.35. Preparation of lubricating oil stock for distillation from crude petroleum.

G. J. Strozynski. U.S.P. 2,006,816, 2.7.35. De-waxing of lubricating oil by chilling the oil rapidly with violent agitation and adding a diluent chilled to a temperature below that of the oil and a mineral acid. The acid-formed sludge and wax are then separated from the oil.

E. Petty. U.S.P. 2,007,546, 9.7.35. Fractional crystallization of waxes in stages in order to obtain segregated wax fractions.

L. J. Ireland. U.S.P. Re. 19,646, 16.7.35. An apparatus is described for reclaiming used lubricating oils (cf. U.S.P. 1,852,350 of 5.4.32), in which the oils are introduced into a heating zone through which steam is passed. A means is provided to carry off the vapours of the oil.

C. F. Tears. U.S.P. 2,008,569–70, 16.7.35. Removal of colour and wax from lubricating oils in one operation.

A. Berne-Allan, Jr. U.S.P. 2,008,674, 23.7.35. Low cold-test oils are produced by chilling with a polymer product obtained by chlorinating to the extent of 10–15% with naphthalene and removing wax by centrifuging.

H. Ramser. U.S.P. 2,009,454, 30.7.35. De-waxing of lubricating oil by using dichloro-difluoromethane as diluent.

U. B. Bray. U.S.P. 2,010,007–8, 6.8.35. Separation of asphalt from oil using liquefied propane.

E. Ayres and H. G. Smith. U.S.P. 2,010,387, 6.8.35. Refining of lubricating oils by treatment with a small percentage of aluminium chloride and a halogenated hydrocarbon at a temperature of 150–300° F.

A. A. Wells. U.S.P. 2,010,423. 6.8.35. Manufacture of asphalts from crude petroleum oil by subjecting the cylinder oil fraction to solvent extraction using phenol or furfural.

F. R. Moser. U.S.P. 2,010,606, 6.8.35. A process of colouring and improving lubricating oils by adding a quantity of polymerized liquid sulphur dioxide extract of a mineral oil.

J. B. Hill. U.S.P. 2,010,819, 13.8.35. Separation of waxes from oils by sweating with a solution of an alkali phosphate.

C. P. Shillaber. U.S.P. 2,012,695, 27.8.35. Still for recovering crank-case oil.

W. S. E. C.

I.G. Farbenind. A.-G. D.R.P. 615,562, 24.6.32. By treating paraffin or montan wax with a high-voltage high-frequency current, a grease containing synthetic products is produced. L. S.

1243. Patents on Fuel Oil. Stand. Oil Dev. Co. E.P. 432,592, 30.7.35. A fuel for high-pressure liquid fuel injection engines which comprises hydrocarbons having a boiling range within or above that of kerosine and a true ester which boils above 302° F.

W. H. T.

1244. Patents on Asphalt. Soc. Res. et Perfect. Ind. E.P. 431,781, 8.7.35. A road-surfacing material comprising tar as a base material and bitumen or pitch as an additional ingredient. The bitumen or pitch is incorporated with the tar in finely powdered solid state, so as to constitute a stable suspension in the tar and to permit spreading of the mixture on the road by normal means. W. H. T.

1245. Patents on Special Products. British Celanese Ltd. E.P. 403,654, 27.12.33. (Amended Specn.). Propylene is separated from ethylene by treatment with 80–90% sulphuric acid at 20–23° C. Ethylene is subsequently removed by means of a separate quantity of acid of lower concentration (87%) at a higher temperature (90–130° C.). The method is used in connection with processes involving the hydration of propylene and ethylene.

Soc. Franc. Cataly. Gen. E.P. 431,966, 18.7.35. Production of ethylene oxide by catalytic oxidation of ethylene in the presence of an inert gas (CO_2) and in the absence of water. The catalyst consists of silver with the addition of gold and/or copper, the reaction being effected at 300–400° C.

E. A. Wernicke. E.P. 432,797, 2.8.35. Sulphonation products are produced from mineral oils, etc., by pretreatment for the removal of colour-producing material followed by treatment with sulphuric acid (80%).

F. M. Rogers. U.S.P. 2,007,146, 2.7.35. Removal of naphthenic acids from hydrocarbon oil by passing the latter in vapour form through molten caustic alkali.

B. E. Carl. U.S.P. 2,007,365, 9.7.35. Medicinal oil is prepared by treatment of a suitable base oil with aluminium chloride at atmospheric temperature. The treated oil is washed first with 60° Bé. sulphuric acid, then with fuming acid followed by further treatments with 60° and 30–35° Bé. acid, and finally with dilute $N/10$ acid. The oil is washed with water, clarified by warming at 200° F., filtered through clay, distilled, then contacted hot with dried fine clay and filtered. W. H. T.

1246. Patents on Coal and Shale. H. J. Holford. E.P. 431,397, 5.7.35. Distillation apparatus in which carbonaceous material is spread in thin layers on shelves, where it is heated in contact with superheated steam. A body of hot refractory material of large heat capacity is maintained in proximity to the distillation zone, to minimize temperature fluctuations. W. H. T.

Class 700. Utilization.

1247. Gas Plant Remodelled. J. C. Albright. *Oil Weekly*, 22.7.35, **78** (6), 29.—Several improvements and additions were made to the compressor station, at Huntingdon Beach, of the Industrial Fuel Supply Co. in order to meet the enlarged production and demand for fuel.

The principal change in the plant was in the final cooling units. As a result of certain deductions and investigations, the flow of gas through the cooling units was reversed, the gas entering the cooling sections at the lowest point. Temperatures with an average of 80° F. were obtained after the change as compared to the average of 90° F. before reversing the flow of gas.

This 10° fall in temperature has increased the amount of gas which the line will carry. L. V. W. C.

1248. Plotting the Results of Oil Engine Tests. E. R. Briggs. *Engineer*, 1935, **160**, 197.—The author has deduced a method for plotting engine test results, which shows a direct comparison between different engines, whatever their rating may be.

It is usual to draw a curve of fuel consumption in lb. per b.h.p. hour, against the power output of the engine. This has the disadvantage that it does not bring out the rating of the engine, and does not lend itself readily to comparison with other tests. The total consumption of fuel in lb. per hour may also be plotted against the engine output. This is a more useful curve, but is even less comparable than the former; as it does not show any measure of the efficiency, such as consumption per unit power.

For ordinary purposes it is required to know the brake mean effective pressure, and the fuel consumption in lb. per b.h.p. hour; also it may be convenient to know the thermal efficiency, the heat consumption in B.Th.U. per b.h.p. hour, or in B.Th.U. per cubic foot of working stroke.

The new method of plotting is to draw a curve of the b.m.e.p. multiplied by the consumption in lb. per b.h.p. hour, against the b.m.e.p.

The shape of the curve is, therefore, exactly the same as that which would be obtained by plotting the total fuel against the b.h.p. output of a constant-speed engine. The latter has no comparative value, but the new method enables a direct comparison to be made.

Two diagrams may be combined into one, by drawing radial lines from the origin to show either the fuel consumption in lb. per b.h.p. hour, or the thermal efficiency. In the case of the former, interpolations must be read on vertical lines, and in the case of the latter, on horizontal lines.

Similarly the radial lines may be drawn to represent B.Th.U. per b.h.p. hour, but then the diagram is true for one calorific value of fuel only; unless the scale of ordinates is one of b.m.e.p. multiplied by B.Th.U. per b.h.p. hour.

Curves of the performance of several different engines, drawn this way, are given by the author, and clearly illustrate the direct comparison obtained. J. A. C.

1249. Vapour-Lock Traits of Cars and their Limitations on Gasoline Volatility. N. MacCoull and E. M. Barber. *J.S.A.E.*, 1935, **37**, 237–246.—Vapour lock is fundamentally a problem of fuel-system temperature control. This temperature is usually higher when the engine is idling after a run than during the run itself; hence vapour lock is more common when the car is stopped or slowed down. Vapour-locking properties of gasoline cannot be specified by one property alone, such as Reid vapour pressure, since the volume of vapour per unit volume of liquid varies for different cars over a wide range. Two measurements at least are necessary so that the initial boiling temperature and rate of vapour formation at temperatures above the initial boiling point can be determined. Approximate values may be obtained by the usual A.S.T.M. distillation with the thermometer bulb actually in the liquid. The temperature at which bubbles first begin to rise is noted, and also the percentage of condensate at various temperatures. The latter $\times$ 240 gives approximately the volume of vapour. Approximate results may also be obtained using the Reid vapour-pressure bomb, charging the latter with several quantities of liquid, and noting the vapour pressure at a series of temperatures for each vapour/liquid ratio, and then determining the true boiling point by noting the temperature at which the vapour pressure equals atmospheric. A specially designed barometric type of vapour-pressure apparatus is, however, more satisfactory.

Mechanical methods of measuring vapour lock are discussed, and the makeshift expedient of boiling off and rejecting the most volatile portion of the fuel is criticized. Freedom from vapour lock and easy starting can be obtained only if the fuel systems of cars are redesigned to use easy starting fuels without vapour locking. Temperatures at various points of the fuel system were measured by iron-constantan thermocouples connected to a null-type potentiometer. C. C.

1250. Trends in Engine Design as Influenced by Fuel Volatility. J. M. Campbell, W. G. Lovell and T. A. Boyd. *J.S.A.E.*, **37**, 307–312.—The authors make a comprehensive analysis of the modern trends in design as affected by the chief properties of fuels, viz. volatility and knock rating, and point out the need of a system of classifying fuels in terms of volatility and the necessity for careful adaptation of engines to fuels and vice versa to the best advantage of the motoring public. C. H. S.

1251. Optical Indicator. Anon. *Aut. Eng.*, 1935, **25**, 309–310.—A new mechanical-optical indicator designed at the Delft research station of the " Bataafsche Petroleum Maatschappij " is described. The instrument, which is not claimed to be new in principle, is an attempt to produce a satisfactory indicator for high-speed engines, utilizing as the pressure element a diaphragm on which is mounted direct a prism, thus measuring the angular displacement of the diaphragm with a light beam on a photographic or optical screen. The time base of the diagram is obtained mechanically by driving an abscissa mirror from an eccentric, the whole of the apparatus being very rigidly mounted in a solid bronze block. The instrument can be used for obtaining P.T. diagrams or for recording spray valve pintle motion, and it is claimed that the indicator can be fitted very close to the motor even in the most unfavourable circumstances. C. H. S.

1252. Automatic Power and Mixture Control for Aircraft Engines. G. E. Beardsley, Jr. *J.S.A.E.*, 1935, **37**, 301–306.—The high performance demanded from modern aircraft engines renders the former practice of allowing the pilot to use his own discretion as regards mixture control a dangerous procedure. The present article gives an account of the apparatus used and the results obtained in developing the idea of the late T. Hiscock, who suggested that the density of the air entering the carburettor and the air–fuel ratio should be maintained at that obtained at 7000 ft., irrespective of the actual altitude of the plane. The apparatus described is an automatic power and mixture control unit attached to the carburettor. From the tests made it is clear that very much more constant consumption figures are obtained than with a manually controlled carburettor, and from a safe operation point of view the apparatus fulfils the requirements with certain limitations. C. H. S.

1253. Insulating with Bitumen. C. R. Platzmann. *Asphalt u. Teer*, 1935, **35**, 401–403.—A summary is given of the difficulties found in obtaining satisfactory bituminous coatings for insulating purposes. To obtain satisfactory results on concrete or mortar, for example, the surface must be completely set and hard, clean and dust-free. If cold bituminous paint is applied, at least 3 or 4 days should elapse between successive coats to allow complete evaporation of the solvent. To obtain thick coatings, a very fluid bitumen solution should be applied as a first coat, in order to obtain good penetration and consequent adhesion. A preliminary application of cold paint is preferable also when hot bitumen is to be applied. Sufficient time must elapse for complete drying of the under-coat before applying the hot bitumen. In many cases it is desirable to dry the surface which is to be insulated by means of a blow lamp. C. C.

1254. Oil as Insecticide. Anon. *Petr. World*, 1935, **32** (419), 206–208.—A summary of H. Martin's paper " The Standardization of Petroleum and Tar Oils and Preparations as Insecticides." To cover all requirements five grades of oil are necessary, two for tar and three for petroleum oils. Distillation test, Redwood I. viscosity and sulphonation test are the chief tests to grade and sub-grade the oils. The uses of each grade are specified. G. R. N.

BOOK REVIEWS AND BOOKS RECEIVED.

Reviews.

LE PÉTROLE ET SON ÉCONOMIE. With Preface by Louis Pineau. Pp. 220. 1935, La Librairie Technique et Économique, Paris. Fr. 30.

A SERVICE of particular value to the Petroleum Industry in general, and the financial side in particular, has been rendered by the publication of this valuable compilation of the Economics of the Petroleum Industry.

With such a vast amount of valuable data, it is difficult, if not impossible, to stress any particular portion as being outstanding. The whole volume bears the mark of careful preparation and compilation of facts by the authors of the various sections, whose work shows that they are truly cognizant of the material they are handling, although, at times they appear, and are almost bound, to handle it from a nationalist standpoint. Truly a text-book which will give future students, and particularly French students, a rare opportunity of being brought up to date with reliable information as to the great Oil Industry.

Undoubtedly the deepest general interest will be shown towards the preface by Louis Pineau—imaginative, idealistic, forceful, and yet with all perhaps disappointing, because one looked for a clearer call to the Industry and to those in authority from this commercial dictator—probably the greatest in living history. Louis Pineau praises the historian and the technician, but in his references to the public and to the press he is strong, and even bitter, in his denunciation.

He blames them for their lack of knowledge, and in regard to the country's manufacturers, he deplores their want of vision.

In all these things one wonders for how much the dictator himself is to blame, particularly where he refers to the restrictions and burdens the Industry has to bear.

A most careful study of M. Pineau's preface shows the danger of too much protection and the calamity of dealing with an industry such as oil in peace time on the basis of control by military and naval authorities in time of war.

It also seems that one can hope in the future from the oil control in France a desire to see fair play extended to the smaller merchant, to enable him, if only for the benefit of the nation, to derive some reasonable profit for his labours and save him from extinction by the larger interests.

It is obvious that Louis Pineau has a wide vision and would do justice, if he were more free to use his great position and intellect for the benefit of the trade he so forcefully controls.

Finally, there is warning of more changes to come, but no indication as to the possibilities, and the preface makes the reader wish for more from the same pen.

THOS. C. J. BURGESS.

PETROLEUM DEVELOPMENT AND TECHNOLOGY, 1935. Pp. 554. New York. American Institute of Mining and Metallurgical Engineers. 1935. $5.

"Petroleum Development and Technology, 1935" constitutes an almost complete review of the oil situation in the U.S.A. The papers contained in this volume were some of those read before the Petroleum Division of the American Institute of Mining and Metallurgical Engineers at their October 1934, and February 1935, Sessions, and the information contained in them is of value to all connected with the Petroleum Industry, whether their interests are towards the engineering or towards the legal side of the industry.

More than half the volume is devoted to Chapter V, Production, Domestic and Foreign, but the information contained is much more comprehensive than in previous publications, and the reports have been augmented by clear and concise tables showing oil and gas production, amount of drilling, the formations from which production is obtained, etc.

A further feature of this volume is the publication of a paper dealing with the economical selection of sucker rods which was delivered at a joint symposium with the Institute of Metals Division. A number of papers dealing with the use of metals in the Petroleum Industry are mentioned in the contents, and their references are quoted.

Chapter I contains twenty-one articles dealing with Production Engineering and

Engineering Research, covering such subjects as rotary drilling fluids, pressure gradients, casing-joint design, efficiency of flowing wells, gas solubility investigation and water-coning.

The initial paper, on the estimation of petroleum reserves in prorated fields, is of interest in sand fields, but does not include limestone reservoirs under restricted production.

The influence of well diameter on the pressure gradient and rate of flow of oil through the reservoir rock has been investigated by Professor L. C. Uren and his assistants, and the principal conclusion of interest to petroleum engineers is that large-diameter wells will show substantial advantages over small-diameter wells.

Clays and drilling fluid are dealt with in two published articles, and referred to in two others in the contents.

The problems of cementing oil wells are investigated, and the results recorded in a paper entitled "Effect of Temperature, Pressure and Water-Cement Ratio on the Setting Time and Strength of Cement."

An interesting paper by C. J. May deals with the subject of efficiency of flowing wells, and summarizes results and calculations of an investigation in the Masjid-i-Sulaiman field.

Gas solubility investigations are discussed in an article by A. B. Morris, and E. A. Stephenson develops a general form of equation showing the rate of change in viscosity per unit change in quantity of dissolved gas in an article entitled "Fundamental Operating Pressures in Oil–gas Reservoirs."

The fundamental physical principles underlying the behaviour of the water–oil interface, when oil is produced from a well only partly penetrating the oil zone while the water remains in static equilibrium in the lower portion of the oil horizon, are expressed in an article dealing with water-coning in oil production.

Stabilization and petroleum economics are given smaller space than is usual, but the contributions are by distinguished writers, and will well repay their study.

The volume is completed with a review of the development in petroleum refining engineering during 1934.

As is usual with this publication, all the papers are authoritatively written and excellently presented. The work can be heartily commended, and it should find a place in the bookcases of all interested in the petroleum industry.

L. V. W. Clark.

Books Received.

Department of Scientific and Industrial Research: Report of the Road Research Board for the Period Ended 31st March, 1935. Pp. ix + 133. 1935, H.M. Stationery Office, London. 2*s.* net.

This report covers the period from April, 1933, when the Department assumed responsibility for the researches on roads carried out at the Road Research Laboratory, Harmondsworth, Middlesex.

The report shows that considerable progress has been made in a very comprehensive programme of research in the problems involved in the making and upkeep of roads and on the still more urgent problem of road safety.

The section on Road Construction is divided into two main headings, Materials and Processes. Under Materials the subjects of Soil Physics, Aggregates, Fillers and Mixtures, and Binders are dealt with in detail, while the sub-section on Processes is concerned with Concrete Roads, Bituminous Roads, and Surface Dressings.

The two remaining sections deal with Road Usage and the Development of Special Testing apparatus.

Institution of Automobile Engineers. Proceedings, Vol. XXIX, 1934–35. Pp. xx + 810. Pl. XLVII.

Contains papers read before the Institution during the Session October 1934 to March 1935, together with the discussions thereon. The following are included: "Small Oil Engines for Road Transport," H. O. Farmer; "Piston Temperatures in High-Speed Air and Water Cooled Petrol Engine Cylinders," H. Wright Baker; "Colloidal Graphite as an Adjunct Lubricant for Automobile Engines," H. Higinbotham; "Diesel Power and the Automobile Engineer," H. O. Field.

JAVA. GEOLOGISCHE KAART, SCHAAL 1 : 100,000 :

TOELICHTING BIJ BLAD 54 (MADJENANG). W. H. Hetzel. Pp. 53.

TOELICHTING BIJ BLAD 58 (BOEMIAJOE). C. Ter Haar. Pp. 65.

U.S. BUREAU OF STANDARDS :

SEPARATION OF PETROLEUM HYDROCARBONS WITH SILICA GEL. B. J. Mair and J. D. White. Pp. 12. 1935, Superintendent of Documents, Washington, D.C. 5 cents.

The fractionation, by filtration through silica gel, of a number of binary mixtures of pure hydrocarbons (b. p. 80–175° C.) is reported. A simple laboratory method for the removal of aromatic hydrocarbons from naphthene or paraffin hydrocarbons by adsorption on silica gel, with a recovery of 98 per cent. or better, is described.

U.S. BUREAU OF MINES :

" BASE " OF A CRUDE OIL. E. C. Lane and E. L. Garton. Report of Investigations 3279. Sept. 1935. Pp. 12.

A revised system for the classification of crude oils according to their base is presented. There are nine possible classes : 1, Paraffin base; 2, Paraffin-intermediate base; 3, Intermediate-paraffin base; 4, Intermediate base; 5, Intermediate-naphthene base; 6, Naphthene-intermediate base; 7, Naphthene base; 8, Paraffin–naphthene base; 9, Naphthene–paraffin base. The presence or absence of wax can be indicated by the addition of " wax-bearing " or " wax-free."

Analyses of typical crudes in the first seven classes are given, together with details of the method of determining the base. No crude oils have been found which would fall in either of classes 8 or 9.

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Class 200. Geology and Origin.

1255. Relationship of Mud to Electrical Coring. H. C. H. Thomas. *J.I.P.T.*, 1935, **21**, 774–789.—A lecture with discussion at the Trinidad branch on resistivity and porosity profiles, the measurement of resistivity, the effect of mud on resistivity and on porosity and the interpretation of combined logs. G. R. N.

1256. Long Beach. B. Mills. *Oil Weekly*, 12.8.35, **78** (9), 31–36.—No field approaches this as regards oil recovery per acre. Three major producing zones are recognized, but oil might readily be produced through one well, since there is no intervening water nor a long break. Each major zone is divided into many thin layers of sand and shale. The average recovery is 400,000 brls./acre, and the average depth of the wells is 5400 ft.

The main production has been obtained from the Alamitos (extending from 2500 ft. to 3400 ft. deep), Brown (3400–5200 ft.) and the Deep zones, with some from the Wilbur above the Alamitos. The Brown is divided into two distinct parts in some portions of the field. The first deep zone extends 5200–6400 ft.; the second is below 6400 ft., and a further deep zone lies below 8000 ft. On the crest of the structure the Alamitos and Brown could be produced simultaneously, giving 2750 ft. of productive zone. On the edge this is impossible owing to water troubles.

The field is an elongated dome, being one of nine structures aligned between Newport Beach and Beverly Hills. It is on a horizontal fault plane which is responsible for much of the Los Angeles basin production. During the past few years development has proceeded south of the major fault line.

Now most of the wells are pumping and producing large volumes of water, from which iodine is extracted. Many of the wells are being plugged back to produce from thin streaks overlooked in the initial rush for large production. G. D. H.

1257. Geology of the Petroliferous Areas of South America and the Islands of the Caribbean Archipelago. I. Trinidad. M. E. Lehner. *Ann. des Comb. Liq.*, 1935, **10** (4), 691–732.—From a geological and biological viewpoint, Trinidad shows closer relations with Venezuela than with the Antilles. The oldest rocks (Caribbean series) form the core of the Northern range, and show varying degrees of metamorphism, but are possibly Jurassic in age. The lower Cretaceous is seen near Point à Pierre and in the Central range. An important gap exists between the Aptian and the upper Senonian (upper Cretaceous). Sporadic occurrences of lower Eocene have been noted in the Central and Southern ranges. Middle and upper Eocene occur, but lateral variation, lack of fossils and tectonic complexities have made their elucidation difficult. Proved Oligocene is rare, but there are evidences that it should have been formed. The Miocene is well developed and possesses the main oil horizons. It is of four types, as seen on the northern flank of the Central range, resting unconformably on Cretaceous or Eocene; the southern flank of this range; the basin between the Central and Southern ranges; and the Southern hills. Pliocene is developed mainly in the northern depression of the south-west peninsula and in the Guayaguayare area. The mud volcanoes are the most interesting features of the Quaternary.

Tangential movements have been the most important tectonically, but the less marked vertical dislocations have played an important part in oil accumulation. Simple anticlines and overthrusts occur. Movements are clearly shown in the Cretaceous, lower and middle Eocene, and the beginning of the middle Miocene is marked by a regional transgression and unconformity. The last important movement

may coincide with the reduction in salinity of the waters at the close of the Miocene or early Pliocene, although Pliocene beds may dip at 20°.

The main direction of folding is N. 70–90° E. in the north and south, parallel to the main structures of Venezuela; N. 60–80° E. in the Central range; in the east there are evidences of a superimposed N. 35° E. trend; and a N. 115° S. trend is seen in the Point Fortin anticline. The relative ages of the trends are important, but obscure, and the directions of the movements are uncertain.

The numerous surface evidences of oil are confined to the southern half of the island, more particularly to the basin south of the Central range. They occur in beds ranging from Cretaceous to Quaternary, but mainly in Miocene beds. The main fields are in the south-western peninsula, finding oil in the lower Morugas or Forest sands. The best production is obtained on the flanks of the anticlines, and sands tend to be lenticular. The oil is generally admitted to have migrated to the upper Forest sands, but may be indigenous to the lower Forest sands. However, some would place the source rock deeper, even Cretaceous.

A list of fields and productive sands is given, and the possibilities of discovering new fields are discussed. The places with the best chances are deemed to be the Forest sands of the depression south of the Southern range, and the Naparima basin between San Fernando and Rio Clara. A correlation table, tectonic map, N.–S. cross-section, bibliography with 156 references, and sources of geological and topographical maps are included. G. D. H.

1258. Is there Oil in Abyssinia? E. H. Cunningham Craig. *Petr. Times*, 1935, **34**, 271.—The greater part of Africa consists of rigid, hard, old rocks. Only in the north, and to a slight extent in the south, have folding movements affected the younger strata which have been deposited in coastal belts and in depressions on this massif. Thus oil has been concentrated in the folded Moroccan belt and in Egypt. In British Somaliland and the adjacent part of Abyssinia oil does occur in shallow basins among the older rocks, but lack of folding, with consequent lack of concentration, has precluded commercial production. Tertiary beds have been deposited in the Rift valleys, and often good seepages occur, as on the shores of Lake Albert, but the existing conditions of tension seem to indicate the absence of folding and accumulation.

It is certain that Abyssinia has no potential oil-field which, having regard to its position, could be a commercial success. G. D. H.

1259. Geophysical Electrical Prospecting and Evaluation of Productivity of Layers. A. Kagan. *Azerb. Neft. Khoz.*, 1933, 11–12, 20–25.—The geophysical electrical prospecting method is analysed, and it is concluded that:

(1) Layers with a low specific resistance, *i.e.* with a water horizon, are marked on the resistance diagram by an almost constant figure, which is close to the specific resistance of the layer. In these layers the diameter of the bore hole, as well as the specific resistance of the drilling solution, can be disregarded.

(2) When investigating layers of high resistance, these factors are of a deciding importance, and a simple comparison of the resistance diagrams for bore holes of various diameters and with various drilling solutions may lead to great errors.

(3) When calculating the specific resistance of the mineral by the V. A. Foch method, the influence of the basic column of the drilling solution may be disregarded, and in the case of a number of layers a diagram (*a*) may be obtained, which will reflect the physical properties of the layer to a much better extent than a simple specific resistance diagram. However, an increase in the diameter of the conducting column, because of the penetration of the drilling solution into the layer, will be shown in the diagram, and therefore in the case of highly resistant layers, this, as well as the ordinary resistance diagrams, will not show the difference in the specific resistance of the minerals, but the difference in the pressures, penetration, etc.

(4) Since the apparent resistance depends also on the ratio of the thickness of the layer to the size of the prospecting installation, changes in the latter when working with bore holes of various diameters will be reflected on the resistance diagrams, interfering with their comparison.

(5) Therefore, when referring to diagram (*a*) it is essential that tables for the equation characterizing the ratio of the specific resistance of the surrounding medium to that of the specific resistance of the column with the drilling solution be provided for the

most popular apparatus, and for all diameters of the bore holes to be investigated, or, since it is difficult to provide these tables, curves may be substituted.

(6) It is necessary to investigate the specific resistance of various mud solutions and their influence on the pressure, temperatures, etc., on this specific resistance. The specific resistance of the mud solution should be determined with the greatest care before each prospecting investigation.

(7) The aforesaid explains the unsteadiness of the upper limits of the resistance, and this may give some indications for the best location of bore holes to be drilled. A literature index containing 11 references is appended. For. Petr. Techn.

Class 300. Development and Production.

1260. Life of Drilling Bits Extended and Old Ones Repaired by Hardening Edges. C. P. Bowie. *Oil & Gas Journal*, 29.8.35, **34** (15), 36.—The process of hard surfacing drilling bits has progressed rapidly in the last few years, and marked economies in drilling have been effected by this method. A satisfactory hardening material must give a reliable bond with the parent metal and have resistance to abrasion and shock. It is found that the tungsten carbide alloys have these properties to a marked degree, although the alloy is at present rather expensive.

The author describes the preparation of the alloy from tungsten ores, and discusses the composition and heat treatment of the steel of the bit for successful hard surfacing, together with the various methods of carrying out this process.

The A.P.I. has issued a series of recommendations for hard surfacing bits, and these are given in full.

The cost of hardening varies from $1·50 to $1·75 per inch of blade treated, and it is stated that drilling is accelerated from two to ten times by the use of this process.

L. V. W. C.

1261. Dynamics of the Performance of the Bit in Rotary Drilling. A. I. Shakhnazarov. *Azerb. Neft. Khoz.*, 1933, **2**, 38–41.—The following items are discussed: (1) Determining the load on the bit. (2) Indices of the drillo-meter. (3) Losses in the weight of the tool during its movement. It is concluded that: (*a*) The standards of loading the bit used in the above investigations are not justified either in theory or practice. (*b*) The weight indicator shows the tension of the cable in its stationary end. (*c*) The tension of the cable is not a criterion for the weight of the tool in the bore hole, the forming being subjected to many changes and depending to a great extent on the friction of the tool. (*d*) The velocity of lowering the tool at a constant number of revolutions of the rotor used as the basis in the above calculation is justified from both the theoretical and practical points of view. (*e*) The specifications developed for the lowering of the bit at various hardnesses of the soil need further checking.

For. Petr. Techn.

1262. Methods for Brazing Hard Alloys on Bits with Copper and Natural Gas. D. Krepkov. *Neft. Khoz.*, 1934, **26** (2), 33–37.—On the basis of described investigations, it is said that the material from which the bits are made is of satisfactory quality, although the carbon content should be more uniform. The microstructure of the material of the bits, which were brazed by the Duel method, is normal. The cause of cracks in the "fish-tail" bits occurring during the sharpening is due to the copper which diffuses into the metal of the bit on the boundaries of the grains forming layers which cause cracks in the forging process. Electrically brazed bits do not show cracks because the copper is alloyed to a great extent. Thus, in the reconditioning of worn bits the copper should first be removed with a gas burner and the other metal with an electric arc, or the edge may be cut off entirely one quarter inch above the upper limit of brazing. The composition of the brass and steel used for the bit is tabulated, and a number of microphotographs are given. For. Petr. Techn.

1263. Hard Facing Oil-field Drilling Bits with Metallic Boride Crystals. M. C. Smith. *Petr. Eng.*, Sept. 1935, **6** (13), 46.—Metallic boride crystals have a hardness of about 9 on Moh's scale, possess a high melting point, and are resistant to oxidation, even at high temperatures; consequently they are suitable for welding into bit faces for hardening purposes.

The procedure is more simple than that used for the tungsten carbide type of

hardening process, for, owing to the absence of oxidation, the inserts of boride crystals, in the form of small rods, granules or other shapes, are simply sunk into the bit by the local melting of the parent metal. After sufficient inserts have been welded in place, the rest of the bit surface exposed to wear may be hardened by dusting over with granules or fine powder of boride, and applying the torch just long enough to sink the boride into the parent metal. The bit may then be heat treated without the boride crystals losing their wear-resisting properties.

These crystals are as hard, if not harder, than tungsten carbide, and have a chemical action on any binder base metal used with them, causing the base metal itself to become harder and tougher. This new hard surfacing method will undoubtedly have a wide application for the treatment of drilling tools. L. V. W. C.

1264. Calculating the Drilling Cables. G. M. Sarkisov. *Azerb. Neft. Khoz.*, 1933, **4**, 5–11.—The Relo equation usually applied in the calculation of the strength of the cable gives unsatisfactory results. The stresses depend on the winding angle of the individual wires. By changing the winding angle, the cable can be brought up to the required strength. Thus, for a 1-in. cable the best construction would be 180 wires, diameter 1·2 mm., winding angles β_1 20° and β_2 42°. A number of equations are deduced. For. Petr. Techn.

1265. Efficiency of Oil-field Boilers May be Increased by Treating Feed-water. J. F. Bingham. *Oil & Gas Journal*, 5.9.35, **34** (16), 51.—Boiler water may be treated by the injection of patent softening compounds, of which there are many varieties, into the feed-water, but this is not recommended for oil-field waters, and should be done only under expert supervision, owing to the complications which may ensue from unskilled treatment, with resulting rapid scale formation and possible corrosion.

The reactions of the lime–soda–alum water softening process are explained, together with the soap solution method for measuring water hardness.

The amount of lime required to treat an oil-field water, calculated from the results of the soap solution test, is given, and a typical water-treating plant on one of the Oklahoma fields is described.

The author then explains the meaning, and methods of measuring, hydrogen in concentration, and briefly states the two theories of caustic soda embrittlement of boilers, and shows that the concentration of Na_2CO_3 must be kept low or embrittlement will result. Safe limits for the allowable amounts of this impurity are also given. L. V. W. C.

1266. Generating Plant for Driving A.-C. Drilling Rig. W. C. Lane. *Petr. Eng.*, Sept. 1935, **6** (13), 52.—With the advent of light portable I.C. engines of high output, it has become possible to generate electric power near the wells to be drilled, and thus eliminate transmission difficulties.

There are three ways of arranging engine and generator in use at present. The first consists of two or more complete engine and generator units. During heavy load all generators are operated in parallel; when the load is light some units are shut down. The method has disadvantages owing to the "hunting" action which may be set up when several separate generator units are run in parallel, and is seldom used now.

The second method is the simple one of a large engine and generator of sufficient power to meet all contingencies; unfortunately this leaves no reserve in case of breakdown.

As generators are usually reliable, and trouble generally occurs in the engine, the third combination consists of several engines driving one large generator through a clutch drive, so that one or more engines can be used, as desired. This type of unit has been very successful, an example being the set-up recently installed for a Kansas company, consisting of one 375-k.v.a., 480-volt, 3-phase, 60-cycle, 1200-r.p.m. generator with a directly-connected exciter coupled to the line shaft and driven by one, two or three 14 × 18 horizontal, twin-cylinder, semi-diesel engines, giving 250 h.p. each at peak load.

The entire assembly is mounted on a steel structure, and the whole, including auxiliary equipment, is neat and compact, and has given very satisfactory results. It is probable that this type of installation will become quite popular on some fields.

L. V. W. C.

1267. Direct-reversing Diesel Drives Rotary on Deep Drilling Well in Ventura Avenue Field. W. A. Sawdon. *Petr. Eng.*, Sept. 1935, **6** (13), 29.—Although diesel-driven D.C. generator sets, furnishing power for electric rig installations, have been used for some time in the Ventura Avenue field, the technical difficulties of using direct-driven rigs have only lately been overcome. The Associated Oil Company have installed a Cooper-Bessemer, FP-8, 8-cyl., 4-stroke diesel engine of the direct reverse type, which gives 400 b.h.p. at 600 r.p.m. It is fitted with a 24-in. Twin-Disc air controlled power take-off clutch built into the fly-wheel, and from this an extended shaft on self-aligning bearings carries a standard sprocket, driving the draw-works by the usual chain drive.

Starting, accelerating and reversing are all done by the driller from a small hand-control lever mounted on the draw-works. Compressed air for the clutch is supplied by a small electrically driven compressor, and the oil pumps are also electrically operated, whilst the slush pumps are steam driven, in order to study the performance of the diesel on the draw-works and table only, without interference from auxiliary equipment. The fuel consumption is about one barrel of oil per day.

After the driller had become accustomed to the clutch and reversing gear, drilling progressed as smoothly and as quickly as with the familiar steam-driven units, and the results obtained have fully justified the installation of this new and admittedly experimental unit. L. V. W. C.

1268. Diesel-powered Direct-current Electric-drilling Units cut Wildcatting Costs. L. G. E. Bignell. *Oil & Gas J.*, 22.8.35, **34** (14), 22.—The cost of water and fuel totals a considerable sum when a number of wildcats are being drilled, and to reduce this cost it is now common practice to use rigs powered with internal-combustion engines.

The diesel engine has been introduced into this field within the past few years, and diesel-powered D.C. generator units have recently been developed.

A full description of this plant is given. L. V. W. C.

1269. Using Casings in Deep Drilling. S. I. Shishchenko. *Azerb. Neft. Khoz.*, 1933, **8**, 6–13.—The conditions existing in deep wells are analysed, and it is concluded that: (1) The increase in the depth of the bore hole requires a heavier gauge tubing to withstand the higher pressure exercised by the earth and by mechanical factors. (2) The use of a check valve, when lowering the tubing accompanied with cementing, will permit work at greater depths. (3) Welded tubes are not so good as drawn tubes. (4) The impact strength should be of the magnitude of 70 kg./sq. mm. at a proportionality limit of at least 40 kg./sq. mm. (5) One of the main factors to be stressed is the use of tubes of a strictly circular shape. (6) The best equation for the calculation of the strength is that derived by the Grozny Petroleum Research Institute. For. Petr. Techn.

1270. Union Oil Sets Heaviest String of Casing. Anon. *Petr. Eng.*, Sept. 1935, **6** (13), 56.—In July the Union Oil Company set the heaviest string of casing ever run in California on a well in the Kettleman Hills field. The string was of 8¾ in. diam. and was set to 9081 ft.: it weighed 326,916 lb. L. V. W. C.

1271. Cementing Properties of Portland Cement. I. A. Aleksandrov. *Azerb. Neft. Khoz.*, 1934, **2**, 27–33.—It is stated on the basis of a great variety of experiments that a cement which has good setting properties with about 25% water may have very unsatisfactory setting properties when adding 50% or more water. Thus, the addition of 5% calcium sulphate may impose good setting properties to cements in the presence of an excess of water. Cements containing large amounts of Al_2O_3 which were burned at high temperatures and which do not contain appreciable amounts of free CaO, but which are highly saturated with CaO, are suitable for cementing oil wells. Moreover, these properties may be incorporated into cements by the addition of various accelerators such as $CaSO_4$–$2H_2O$, $CaCl_2$ and NaCl. For. Petr. Techn.

1272. Ordinary Cement for Deep Bore Holes. N. A. Lutzenko and R. I. Grozdovskaya. *Azerb. Neft. Khoz.*, 1933, **3**, 4–11.—The following conclusions are derived from described experimental work:

(1) The setting time of all cements is shortened when using a temperature of 75° C.

(2) The setting periods for the local cements are satisfactory (2 hrs. 50 mins. to 4·5 hrs.).

(3) The Caspian cement is not suitable (setting begins after 85 mins. and ends at 160 mins.).

(4) The mechanical strength of the Caspian cement decreases with increase in pressure.

(5) The mechanical strength of the local cement remains almost constant with increase in pressure.

(6) An increase in concentration of both cements (up to 70%) affects the setting time to a very small extent. Thus, ordinary cement can be used for cementing oil wells. For. Petr. Techn.

1273. Application of Cement-setting Inhibitors. R. I. Grozdovskaya and N. A. Lutzenko. *Azerb. Neft. Khoz.*, 1934, **2**, 23–27.—According to described experiments the application of the following inhibitors has little effect on the retardation of the setting, borax, sodium chloride, sulphate and phosphate, ferrous chloride, soap, calcium sulphate, barium and calcium chlorides, sodium carbonate and silicate and potassium sulphate. The composition of the cement investigated was: volatiles 1·01–1·90, SiO_2 18·90–20·58, Al_2O_3 6·72–8·02, Fe_2O_3 3·30–4·62, CaO 64·2–65·16, SO_3 1·20–1·76 and MgO 1·01–1·39%. The normal cement of the Vorovskii plant in Baku may be used with the addition of a clay solution, calcium hydroxide and disodium phosphate, whilst the Vorovskii ferric cement may be used without an inhibitor.

For. Petr. Techn.

1274. Operating Problems, Drilling Practices Found in Government Wells Field. Anon. *Oil & Gas Journal*, 29.8.35, **34** (15), 44.—Shallow production over a large area with absence of high pressures and other drilling hazards makes the Government wells field of South Texas very attractive to operators. The only difficulty is the scarcity of water, which has led to the use of gas- and petrol-driven engine rigs and pumps.

The oil sand is struck at 2300 to 2700 ft., and the lightest of drilling equipment is used, whilst no attention need be paid to mud conditioning, as it acts solely as a lubricant and carrier of cuttings. From 12 to 15 days are taken by careful operators to drill and complete a well, and costs range from $5000 to $12,500.

10-in. pipe is used for the surface string and 7-in. pipe for the flow string, tubing being 2 in., and the sand is entered for 10 to 20 ft.

Owing to proration wells are not allowed to produce more than from 26 to 40 brls. per day, and are not, therefore, operated over a 24-hour period. On the pumping wells many varieties of hook-up are used, and the chief problem is the soft caving sand, which necessitates frequent cleaning of the wells. L. V. W. C.

1275. Flow Hook-up. F. Swindell. *Oil Weekly*, 2.9.35, **78** (12), 27.—One of the largest gas wells completed in the Mid-Continent area was drilled on a structure reported to be from 1½ to 2 miles wide and approximately 5 miles long, and falling in alignment with the axis of the Oklahoma City Structure.

A showing of oil was met between 7110 and 7114 ft., and the well was completed through the second Wilcox sand to 7291 ft.

The well blew in after bailing to 1000 ft., making a large volume of wet gas under high pressure. After a test the well made 75,000,000 cu. ft. of gas with a shut in pressure of 2750 lb./sq. in.

A description of the hook-up is given. L. V. W. C.

1276. Sucker-rod Failures often Traceable to Incorrect Practices in Oil-fields. W. R. Shimer. *Oil & Gas Journal*, 5.9.35, **34** (16), 48.—Steels operating under the wet conditions existing in wells invariably have a shorter life than when used in dry conditions, and metals which are considered excellent from laboratory tests will often fail unaccountably when in use under service conditions. Many failures are due to careless handling, causing nicking and bending, unbalanced pumping units or heavy momentary overloads given to the rods by inexperienced operators.

Examples of the various types of ill-treatment are given, and an observer system for ensuring that all rods undergo the specified heat treatment in the factory is described. It is suggested that it would repay companies to instal a similar system, keep records of the life of all sucker rods, and have each failure investigated by a metallurgist. It is mentioned that one company did this, enforced strict regulations for the handling of sucker rods, and reduced their rod breaks from 60 to 9 per month.

A method for the treatment of hydrogen sulphide embrittled rods is given.

L. V. W. C.

1277. Salt Water Disposal. J. C. Albright. *Oil Weekly*, 2.9.35, **78** (12), 34.—The operators in the Michigan fields are faced with the disposal of a large quantity of salt water. Particularly is this the case in the Porter field.

An efficient system for disposing of the salt water has been developed by the Pure Oil Company, the largest producer of oil in Michigan.

After the water has been separated from the oil in the lease tanks it is led to a system of gathering pipe-lines. This system is laid in such a manner that gravity carries the water to a centrally located low-pressure pump station. The water enters a series of skimming vats. These vats have three compartments, and the water is piped so that it can only flow from the bottom of the first to the next, and so on to the third. A small quantity of oil comes over with the water, and this must be removed. Two submerged lines enter the first basin, and these deliver water with the small amount of oil so that the oil can float on top of the water.

A pressure of about 650 lb./sq. in. is necessary to deliver the salt water into the final disposal line. The water is pumped to a chemical works, where various chemicals are removed. L. V. W. C.

1278. Salt-water Disposal Wells Solution of Problems for Operators in Kansas. L. G. E. Bignell. *Oil & Gas Journal*, 5.9.35, **34** (16), 45.—Many of the Kansas fields produce salt water with the oil, and it has sometimes been difficult to dispose of this. Recently legislation was passed which now permits operators to return salt water to any formation, not containing domestic water, that will take it, as it is forbidden to dump it in streams or in pits for disposal at high water. Consequently in many of the Kansas fields wells are being drilled into suitable porous formation for the disposal of this unwanted water.

The casing programmes and methods used in these water-disposal wells on the various Kansas fields are described. L. V. W. C.

1279. Crude Oil Characteristics Determine Value of Repressuring Operations. K. B. Barnes. *Oil & Gas Journal*, 5.9.35, **34** (16), 54.—While it is not possible to change the properties of the main body of an oil sand in order to increase production, it is possible to control the properties of the crude oil to a certain extent by the addition of gas—*i.e.* repressuring. This affects both the viscosity and the surface tension of the oil.

Curves showing the effect of natural gas and air on the viscosity and surface tension of crudes, together with solubility curves for various gases in different crude oils, are given, and the probable results of this on the flow through the sand, to the well, are discussed. L. V. W. C.

1280. Diameter of Well Influences Pressure Gradient and the Rate of Oil Flow. L. C. Uren, J. Domerig and J. Mejia. *Oil & Gas Journal*, 5.9.35, **34** (16), 40.—Experiments were carried out in the laboratory on the drainage of oil and gas mixtures through sand, and, qualitatively, the results suggest that wells of large diameter, or those having cavities about them in the reservoir rock give better production, other things being equal, than wells of small diameter.

The authors' apparatus consisted of a 20-ft.-thick steel pipe built in four sections and lined with accurately moulded cement to give a conical tube 80 sq. in. in cross-section at one end and 1 sq. in. at the other, and it thus represents the drainage prism over 20 ft. into 1 sq. in. of a 6-in. diameter well. The cone was filled with tightly rammed unconsolidated sand, and either gas-saturated or dead oil can be pumped through the sand cone at pressures up to 2000 lb./sq. in. by a compressor and pumping unit connected to the large end of the cone. In addition, the whole tube is steam-jacketed and lagged for high-temperature work, and pressure gauges are placed along the tube at intervals, enabling the pressure in the sand at the point to be read off directly. If the screen confining the sand is set 2½ ft. back from the delivery end of the cone, the set up corresponds to production into a 6-in. well, and the second series of experiments was carried out under these conditions.

Results show that the pressure gradient near a large-diameter well is less abrupt than that near a small well, but that, whatever the diameter, the gradient is greater with live than with dead oil. Furthermore, a large-diameter well develops a greater drainage radius under a given pressure, and both the rate of production and the gas oil ratio are lower than with a small-diameter well.

It is suggested that owing to these advantages large-diameter wells should be made in practice by forming, if possible, cavities and fissures in the oil reservoir rock around the drilled well. L. V. W. C.

1281. Controlled Directional Well-drilling and Surveying Practice. J. D. Hughes. *Petr. Eng.*, Sept. 1935, **6** (13), 33.—The various types of deviation of a well are described and the influence of dip and hardness of the strata encountered is briefly discussed. The effect of deviation on the well spacing and the interference of adjacent wells are then dealt with, and it is shown that, in closely spaced leases and in town lots, a deviation less than that legally allowable may cause actual coincidence of two wells at the pay sand, although they may be drilled 300 ft., or more, apart at the surface.

The disadvantages and waste arising from this are obvious, and the author emphasizes the importance of carrying out an accurate well survey, especially for closely spaced wells, if useless and unproductive wells are not to be drilled. L. V. W. C.

1282. Compressed Air and Gas in Oil Production. R. von Zwerger. *Oel und Kohle*, 1935, **11**, 573–576, 604–608, 749–752. (*See also* Abstract No. 911.)—A sufficiently high flowing-level in the well is essential to the success of gas-lift. The production pipe should be immersed in oil to at least 40% of its length, otherwise gas consumption will be too high. On the other hand, too deep immersion necessitates a high gas injection pressure, which tends to neutralize the natural reservoir pressure delivering oil to the well.

The diameter of the production pipe is important, particularly when the daily yield is small. The operation of "kick-off" valves is described; these obviate the high initial gas pressure which is normally required to start production by gas-lift.

An account is given of gas displacement pumps for use when the daily production has become too small to be dealt with by gas-lift. P. G. H.

1283. Water-flooding Projects in Oklahoma are Patterned after Eastern Methods. L. G. E. Bignell. *Oil & Gas Journal*, 29.8.35, **35** (15), 41.—Water flooding of the shallow Bartlesville sand of the Mowata field, Oklahoma, to speed up the recovery of oil, is on the increase, and one experimental 80-acre lease is being flooded under rigidly controlled conditions to test the efficacy of this method.

The five-spot pattern is used, with a spacing of 330 ft., and as the sand is only about 500 ft. down, the wells can be completed very quickly, and are drilled with a portable outfit. It is planned to pump 50–60 brls. of water per day into each well at about 400 lb./sq. in. pressure at the well head, and the flooding will be started about two months before the central oil release wells are drilled—*i.e.* the "delayed flooding" system—the oil wells will be put on pump and new equipment will be used throughout.

The water used can be drawn from several artesian wells, which produce up to 8000 brls. of hydrogen sulphide impregnated water per day. The water is degassed, and, if it is considered necessary, suspended solids will be removed in a filtering plant.

It is estimated that 10,000–12,000 brls. of oil still remain in the lease, and it is hoped to recover 60% of this at the rate of about 160 brls. per day. As soon as the lease is depleted the equipment can be salvaged and used elsewhere, as there are thousands of acres in this field which are reckoned suitable for water flooding, and it is probable that the field will be busy for several years to come. L. V. W. C.

1284. Patents on Drilling Plant. A. L. Leman. U.S.P. 2,011,769, 20.8.35. Tubing head.

O. Martienssen. U.S.P. 2,011,979, 20.8.35. Means for marking cores in boreholes.

R. R. Candee. U.S.P. 2,012,119, 20.8.35. Vacuum bailer.

A. B. Palmer and G. L. Kothny. U.S.P. 2,012,138, 20.8.35. Method and apparatus for orienting whipstocks.

S. H. Williston. U.S.P. 2,012,152, 20.8.35. Method of orienting whipstocks.

J. C. Wright and J. B. Ragsdale. U.S.P. 2,012,294, 27.8.35. Well tool construction.

O. J. McCullough. U.S.P. 2,012,314, 27.8.35. Pipe perforator of the mechanical type.

C. B. Bazzoni. U.S.P. 2,012,455, 27.8.35. Recording instrument for well surveying.

G. L. Kothny. U.S.P. 2,012,456, 27.8.35. Well-surveying instrument.

H. C. Collett. U.S.P. 2,012,499, 27.8.35. Rotary jar.

E. J. Roe. U.S.P. 2,012,774 and 2,012,775, 27.8.35. Under-reamer.

C. W. Scott. U.S.P. 2,013,111, 3.9.35. Period control valve for plunger lift device.

C. W. Scott. U.S.P. 2,013,112, 3.9.35. Means and method for producing fluid from wells.

G. W. Bowen. U.S.P. 2,013,127, 3.9.35. Adjustable rotary jar.

R. B. Bryant. U.S.P. 2,013,129, 3.9.35. Hydraulic pumping system.

C. E. Burt. U.S.P. 2,013,457, 3.9.35. Apparatus for extracting cores from the side wall of well bores.

A. H. Beale and J. A. Hardcastle. U.S.P. 2,013,621, 3.9.35. Elevators.

J. H. Slocum. U.S.P. 2,013,674, 10.9.35. Well-cementing apparatus.

R. O. Pickin. U.S.P. 2,013,838 and 2,013,839, 10.9.35. Roller core and drilling bit.

W. E. Winn. U.S.P. 2,013,875, 10.9.35. Well-surveying apparatus.

F. A. Shaheld. U.S.P. 2,013,903, 10.9.35. Well swab.

A. G. H. Straatman. U.S.P. 2,013,995, 10.9.35. Apparatus for determining the direction of flow of a fluid into a borehole.

E. P. Halliburton. U.S.P. 2,014,563, 17.9.35. Process for plugging back or bridging wells.

F. J. Hinderliter. U.S.P. 2,014,804, 17.9.35. Overshot.

F. J. Hinderliter. U.S.P. 2,014,805, 17.9.35. Apparatus for cutting through the side wall of a pipe.

J. H. Howard and A. C. Catland. U.S.P. 2,014,806, 17.9.35. Core catcher.

B. Williams. U.S.P. 2,014,827, 17.9.35. Sandtrap for pumps.

O. J. McCullough. U.S.P. 2,015,277, 24.9.35. Inside casing cutter.

L. V. W. C.

Class 400. Transportation, Storage and Distribution.

1285. New 88-mile Line in Rio Grande. G. Weber. *Oil & Gas J.*, 22.8.35, **34** (14), 24.—The new 88-mile crude oil pipe-line of the Valley Pipe-Line Co. in the Rio Grande Valley of Texas is 5½ in. outside diameter of electric weld pipe. More than 11,000 Dresser couplings will be required for the complete line.

Three ditching machines are used to cut 30-in. ditches, and after the pipe has received a coating of asphalt paint and been inspected it is buried in the ditch. Where the course of the line will result in bad curves, the line is electrically welded. At canal intersections the line is laid 15–17 ft. deep in a protective 8-in. casing, and suitable valves are placed in the line at all intersections to facilitate future repairs.

L. V. W. C.

1286. Unusual Pipe-line Test. E. Sterrett. *Oil Weekly*, 2.9.35, **78** (12), 31.—In order to test 64 in. of welded 8-in. pipe one company handled 850,000 gallons of water with three duplex duplicate steam pumps so arranged that they could be run in parallel until the line pressure mounted above their 250 lb. working limit, and then, by valves, the pumps could be compounded.

The three pumps used were designed for steam, but as no boilers were available, high-pressure gas under a line pressure of 350 lb./sq. in. was utilized. The gas was used directly in the power cylinders, working it expansively and discharging to atmosphere.

The exhaust gas was piped some 40 ft. from the pumps and ignited.

L. V. W. C.

1287. Half-soling a Pipe-line. E. Sterrett. *Petr. Eng.*, Sept. 1935, **6** (13), 42.—Bad pitting of an 8-in. pipe-line at a location not recognized as a "hot spot" caused a problem, as the line was being operated to capacity, and a shut-down and renewal of the several hundred feet of corroded pipe would have been very expensive.

It was noticed that most of the pitting occurred on the lower half of the pipe, so it was decided to "half sole" the line. After thorough cleaning of the pipe the pits were built up by welding and a thick coating of anti-corrosion material was applied. Lengths of 9¾-in. casing were then split longitudinally by the oxy-acetylene torch, and the inside was also liberally coated with the anti-corrosion paint. There was only a difference of 0·3 in. between the outside diameter of the 8-in. line and the

inside diameter of the 9¾-in. casing, and this was filled up by the anti-corrosion paint. The half sole was then welded in place along the line.

Only short sections were done at a time, the pipe being left in place and the earth being dug away from around it. This removed all chance of strain, distortion and possible fracture.

After welding, the entire line was coated with the paint, wrapped with tar paper and given a hot coat finish, and the whole line was then reburied. L. V. W. C.

1288. Measurement of Benzine Vapour in Admixture with Air. R. Koetschau and G. Schmitt. *Oel und Kohle*, 1935, **11**, 755.—The mixture is burned by passage over a pair of electrically heated wires (*A*) and air is drawn over a similar pair of wires (*B*). *A* and *B* constitute a Wheatstone bridge, and changes in resistance of *A*, due to the extra heat derived from the combustion, cause deflection of a galvanometer needle over a scale which shows proportion of benzine directly.

A portable apparatus is described, which is stated to be especially suitable for testing ships' tanks and to be sensitive to benzine concentrations (0·1% vol.) far below the explosive limit. P. G. H.

Class 500. Properties and Their Determination.

1289. Molecular Weight Methods. E. O. Newman and E. A. Means. *Refiner*, 1935, **14**, 432–435.—The Victor Meyer apparatus as modified by M. Hicks, *Bureau of Standards Journal of Research*, in combination with the baro-burette of H. S. Booth, has been compared with the cryoscopic method for the determination of molecular weights, using known liquids. The vapour-density method is found the more reliable. Graphic comparison of molecular weights of gasoline fractions as determined by the two methods is presented, showing differences from 0·32 to 4·23 in values. Equations and a nomograph for facilitating the calculation of results are given. B. C. A.

1290. Specific Refraction and other Physical Constants in Connection with the Destruction of Mineral Oils. H. I. Waterman, J. J. Leendertse and G. van der Neut. *J.I.P.T.*, 1935, **21**, 816–824.—An account of experiments on the destructive hydrogenation of raffinate and extract from Borneo lubricating oil, and applying the senior author's specific refraction method to determine the number of rings in the molecule of each of the products obtained. G. R. N.

1291. Some Thermal Reactions of Hydrocarbon Gases. F. I. L. Lawrence. *J.I.P.T.*, 1935, **21**, 790–815.—A review of the literature on the thermal reactions of gaseous hydrocarbons with 101 references and numerous patents. G. R. N.

1292. Ignition Temperatures of Hydrocarbons. H. Brückner and R. Schöneberger. *Brenn.-Chem.*, 1935, **16**, 290–292.—Using the apparatus of Bunte and Bloch by which precombustion was largely avoided, the relationship between ignition temperature and the concentration of combustible gas in a vapour–air mixture was traced for the lower paraffin hydrocarbons from propane to heptane, and for the cyclic hydrocarbons, benzole, toluol and *cyclo*hexane.

The paraffin hydrocarbons and *cyclo*hexane possess the lowest ignition temperatures, benzole having the highest, with toluene occupying an intermediate position. The lowest ignition temperature for a given mixture occurs always when the combustible vapour is in excess. The minimum ignition temperatures observed for the paraffin hydrocarbons, propane to heptane, were 586°, 597°, 530°, 560° and 539° C., for *cyclo*hexane 547° C., and for benzole and toluol, 695° and 658° C., respectively. B. C. A.

1293. Volumetric Determination of Evaporation Rates. L. A. Wetlauffer and J. B. Gregor. *Ind. Eng. Chem. Anal.*, 1935, **7** (5), 290–293.—It has been found that distillation range control does not suffice as a precise method for measuring the evaporation rates of solvents and thinners such as petroleum naphthas. Control of uniformity, of great importance in paint and varnish solvents, is therefore assessed by the evaporometer, the basic principle of which is volumetric.

This consists of an air blower, drier, manometer, gas distributor, and evaporative tubes. Air at a definite temperature is passed over 2 ml. of the sample at a definite

pressure, the horizontal evaporation tube being a graduated oil centrifuge tube. At definite time intervals the tube is brought to the vertical, and volumetric readings are taken until 98% of the sample has been evaporated. Time-volume graphs can be constructed and duplication of results to within ± 3% can be obtained without special skill. R. E. D.

1294. Effect of Gasoline Volatility Changes on Automobile Road Performance. J. O. Eisinger and D. P. Barnard. *Oil & Gas J.*, 11.7.35, **34** (8), 34.—Road tests have been carried out with a 1931 Buick car to determine the relation between gasoline volatility changes and the engine performance resulting when corresponding intake manifold and carburettor modifications were made. The actual test consisted in observing the time required to accelerate from 10 to 38 m.p.h. up a uniform 5·5% grade, the octane rating of all gasolines being raised to 75 to preclude the possibility of detonation effects. Thermocouples were located at various places in the intake manifold walls, since mixture temperatures cannot be accurately determined, and experience has shown that the latter are related to manifold wall temperatures measured at a point 2–3 in. from the block. Two series of gasolines were used. In one series the 90% point was kept reasonably constant (315–368° F.), but the percentage over at 158° F. varied between 3·5 and 35·0%. In the other series the percentage to 158° F. was approx. 20, but the 90% point ranged from 217° to 376° F.

The effect of intake manifold wall temperatures ranging from 55° to 267° F. on the hill-climbing performance of one gasoline was determined and the results were plotted. Performances of all gasolines were then ascertained at manifold wall temperatures of 90°, 120° and 155° F. Results were corrected to 90% point of 350° F. for fuels in Series 1, and to 20% over at 158° F. for fuels in Series 2, preliminary analysis having indicated that 1% at 158° F. was approx. equal to 5° F. at the 90% point in its effect. Results show that it is possible to secure the same change in engine performance by varying "front-end" volatility or "total volatility," and also that best performance at any particular manifold temperature is the same regardless of whether it is obtained by providing the necessary "front-end" volatility only or by reducing the 90% point. A curve showing the relation between the percentage which must be evaporated at 158° F. to produce the same volatility effect on acceleration performance as a given change in 90% point has been drawn. From this, lines of equal performance at a given manifold temperature can be drawn, the practical limits being set by starting requirements and dilution restrictions.

The curves illustrate the fallacy of going to extremes in any one feature to obtain some volatility effect, as a similar result may be obtained by a judicious compromise without incurring difficulties which must accompany excessive "front-end" volatilities or very low 90% points.

Attention is directed to the increases in power obtainable by using lower manifold temperatures due to improved volumetric efficiency and the possibility of employing high compression ratios without change in fuel octane rating. If passenger cars could handle present quality winter gasoline in summer, an increase of 7·5–10% in power could be obtained. Intake manifold temperatures should be 30° F. lower in winter than in summer, to take advantage of present differences in volatility, and max. temperatures should not exceed 160° F. in summer or 130° F. in winter. Attention should be given to the prevention of large fluctuations in the temperature of the intake manifold during normal driving conditions. The trend of gasoline volatility during the past four years has been towards improved performance, and the practice of seasonal adjustment is adding materially to this improvement. R. A. E.

1295. Apparatus for Measuring the Boiling Points of Lubricating Oils and Other Compounds of High Molecular Weight at Reduced Pressures. S. T. Schicktanz. *Bur. Stand. J. Res.*, 1935, **14**, 685–692.—It has been shown by Hickman (*J.A.C.S.*, 1930, **52**, 4714) that in the distillation of complex mixtures at pressures $< 0{\cdot}001$ mm. Hg, the temperatures usually obtained in the distilling zone are not truly related to the pressure determined by a gauge in an external part of the system, owing to the unknown variable fall in pressure between these two points.

An apparatus has thus been constructed for determining accurately the b. p. of lubricating oils and other compounds of high molecular weight at pressures below their decomposition points, this data being necessary for the proper re-blending of cuts during systematic separation.

A full description and sketch of the apparatus are given.

The temperatures are determined by three thermocouples situated at different heights in the vapour column, whilst the pressures are recorded with a McLeod gauge. The three temperature readings are identical for a pure substance, whilst for mixtures or impure substances their differences give some indication of the purity of the material.

Curves are given for pure di-*n*-butyl phthalate, for mixtures of this with 6·82, 10·62 and 18·75 mole-% of tri-*o*-cresyl phosphate and for a lubricating oil and its middle fraction.

The data on di-*n*-butyl phthalate are in excellent agreement with results previously obtained by Hickman. D. L. S.

1296. Fractionation of Petroleum Asphalt by Means of Solvents. A. Zwergal. *Oel und Kohle*, 1935, **11**, 608–609.—Five fractions and a residue were obtained by extracting the asphalt with methyl, ethyl, propyl, butyl and amyl alcohols successively, the proportion of each extract varying with the origin of the sample. The third extract (ex propyl alcohol) was found to occupy a special position in all the four samples under consideration; it had the highest C and H contents, lowest sulphur and oxygen, and highest ductility. It is stated that a high proportion (> 90%) of this extract lessens the suitability of the asphalt for treating roofing felt.

P. G. H.

1297. Fractionation of Residues etc. by Means of Natural Gas. S. Pilat. *Oel und Kohle*, 1935, **11**, 655–658.—Fractionation may be effected at room temperature by treating a suitable solution of the residue with methane or natural gas at progressively higher pressures. If a propane–butane mixture is used as solvent, asphalt is precipitated at the initial mixing stage; on subjecting the solution to methane, coloured, resinous material and then oil fractions separate as a second phase as the gas pressure is increased by stages. The fractions so obtained have not been subjected to heat or chemical action, and are stated to approximate to the actual components of the crude oil.

The nature of the solvent greatly affects the efficiency of the operation; a residue dissolved (*a*) in petroleum ether and (*b*) in propane required the application of methane at 130 atm. and 30 atm. pressure, respectively, before a second phase separated.

This method of fractionation is especially suited to the investigation of constituents of high molecular weight, or of those which are sensitive to heat treatment.

P. G. H.

1298. A Study of the Relation between the Structure of Hydrocarbons and their Miscibility with Selective Solvents. S. P. Mulliken and R. L. Wakeman. *Rec. Trav. Chim.*, 1935, **54**, 366.—From a study of the literature on this subject and some preliminary experiments, the authors were led to formulate the following hypotheses: 1. Those solvents which possess hydroxyl, nitro-, or amino-groups and which are miscible with aromatic hydrocarbons tend towards immiscibility with the more saturated ones; 2. The same tendency is shown by neutral sulphates and nitrates of the lower alcohols, but their homologues tend towards miscibility with all types of hydrocarbons; 3. Replacement of hydrogen by alkoxy increases the tendency of a solvent to dissolve hydrocarbons.

The miscibility of nitromethane, ethyl sulphate, aniline and benzyl alcohol with a variety of hydrocarbons was determined at various temperatures. The method of determination is described.

The authors summarize the available data in the following generalizations:

Miscibility of Hydrocarbons with Nitromethane. Among *liquid* hydrocarbons possessing an equal number of carbon atoms but different degrees of saturation, the more saturated usually tend to be the less readily miscible with nitromethane. This is especially true in a series where the only structural difference lies in the amount of unsaturation. 1. Alkanes, *cyclo*alkanes, and di*cyclo*alkanes are immiscible with nitromethane at 20° C.; 2. Alkenes are usually immiscible with nitromethane at 20° C.; 3. Those *cyclo*alkenes tested are immiscible with nitromethane at 20° C. At C_{10} the presence of an additional double bond or ring system, as in the terpenes, is not sufficient to cause miscibility at 20° C.; 4. Alkadienes containing eight or more carbon atoms are immiscible with nitromethane at 20° C.; the lower ones are miscible. The tendency of alkadienes, of the same molecular weight, towards

immiscibility appears to increase as the double bonds approach one another (at least when the final configuration is near the end of the chain); 5. Alkines the triple bonds of which lie near the end of the chain (position 1 or 2) are more soluble in nitromethane than alkadienes of the same molecular weight. Limited data indicate that solubility temperatures rise as the triple bond moves towards the centre of the chain; 6. Aromatics are much more soluble in nitromethane than other types of about the same molecular weight. The lower ones are miscible below 20° C. All those tested are miscible below 55° C.

Among the *solid* hydrocarbons, it appears that, in general, aromatics are much more soluble than non-aromatics of approximately the same molecular weight and melting point.

Miscibility of Hydrocarbons with Aniline and Ethyl Sulphate. The tendency of hydrocarbons of about the same molecular weight to become more readily miscible with increasing unsaturation still holds with these solvents. For a given hydrocarbon, solubility temperatures in them are lower than in nitromethane. Of especial interest is the difference in miscibility of alkenes versus alkadienes and alkines. In general, hydrocarbons of the last two classes have lower solubility temperatures than alkenes of the same molecular weight.

Miscibility of Hydrocarbons with Benzyl Alcohol. In general, alkanes are immiscible with benzyl alcohol at temperatures at which *cyclo*alkanes of the same molecular weight are miscible. In the cases tested, alkanes were immiscible at 50° C., *cyclo*-alkanes miscible.

Hydrocarbons of Unknown Structure. These can be classified by the determination of their miscibility with each of the solvents used above. P. C. K.

1299. Quantitative Measurement of Fluorescence in Mineral Oils. F. Evers. *Oel und Kohle*, 1935, **11**, 746.—The oil sample and a standard ground-glass screen are exposed simultaneously to U.-V. light (about 365 mμ) in a step photometer. The two fields of fluorescence are then compared after successively interposing five spectral filters, each of which transmits only a narrow band of wave-lengths. The intensities of each wave-band emitted by the sample are then expressed as a fraction (L-value) of the total fluorescence; the sums of the L-values thus = 1. For an oil, a luminescence curve (L-value–wave-length) may be plotted, the slope (F-value) of which is shown to be given by the difference between the L-values obtained with the first and last filters, respectively.

The F-value is stated to indicate the electrical condition of an insulating oil during use.

Of a number of standard ageing tests, electrolytic oxidation gave F–values nearest those found in practice. P. G. H.

1300. Combustion Characteristics in Compression Ignition Engines. J. M. Logie. *J.I.A.E.*, 1935, **10** (3), 21–56.—A general survey is given of many of the problems affecting the performance of diesel engines from the combustion and fuel points of view. The author first reviews the thermodynamic considerations and shows how the relative efficiencies of various cycles are judged by the Air Standard Cycle. Curves and diagrams are given which compare the various cycles in use, and the effect of varying injection timing and temperature under different loads. Next, a short section explains how the calorific value of a fuel is determined theoretically. The author then goes on to discuss the phenomena of combustion, which he classes under three headings, viz., inflammation, explosion and detonation. Under the latter heading, after pointing out why detonation as known in the petrol engine cannot occur in the diesel cycle, the phenomenon of " diesel knock " is discussed at some length in the light of several theories and the effects of doping the fuel with a " pro-knock " are discussed. After a description of Neuman's work on the varying combustion characteristics of typical designs of engine, the author deals with the types of fuel in use for practically all classes of diesel engine, and next studies at length the combustion in the three principal types of high-speed engines now in use, viz., the pre-combustion chamber, the direct injection and the air chamber. Finally, fuel injection systems are discussed and appendices give formulæ for theoretical thermal efficiencies, estimation of fuel quantities and excess of air per stroke, size of fuel nozzle required, and relations between pump plunger diameter, orifice diameter and injection pressure. C. H. S.

1301. Cathode-Ray Oscillograph Engine Indicator. E. M. Dodds and C. H. Sprake. *Engineering*, 1935, **149**, 183–186.—The instrument developed by the Anglo-American Oil Co. consists primarily of three main items. (1) A water-cooled carbon pile which is of very robust design and which is virtually free from mechanical inertia, the body of same being integral with the diaphragm, thus obviating gas leakages through the pile. The carbon pile is screwed into a spark plug hole and the diaphragm is flush with the combustion chamber. When the engine is running, the fluctuating cylinder pressures cause the current through the pile and the deflecting coils on the cathode-ray tube to vary, thus giving a vertical motion substantially linear with pressure, or, preferably, a high-resistance pile can be used which operates on a pair of deflecting plates in the tube and functions on high voltage without amplification.

The cathode-ray tube is of the hot-cathode gas-focussed variety, and the D.C. supply of various voltages for filament heating and deflection of the ray is obtained from any A.C. mains by means of a special power unit, which also provides means of focussing the ray and shifting the diagram obtained bodily in a vertical or horizontal direction, so that it may be observed to the best advantage. The power unit also contains a variable bank of resistances and a condenser, which enable the operator to obtain his horizontal time sweep in the time required. The time base which moves the spot in a horizontal direction consists of the resistances and condenser mentioned above and a special double contact breaker driven by the crankshaft.

Briefly, the operation is as follows: Either of two pairs of contacts may be used, one of which gives a long make and a short break, and the other the reverse, both being variable. The breaker is made so that it can be revolved bodily about its axis, the position being indicated by a 360° protractor incorporated. If a full PT diagram is required, the contacts giving the long break are used, and the spot travels across the screen in about 350° of crank rotation, when the contacts "make" and the spot travels back instantaneously to its starting point for the next cycle. By the use of the contacts giving the long "make," it is possible to hold the spot in one position horizontally for 340°, and allow it to travel across the screen during the break of 20°, thus magnifying any desired portion of the diagram. Any point of the engine cycle can be brought to coincide with a datum line on the tube screen by rotating the contact breaker, and the angular delay between fuel injection and ignition in a diesel engine can thus be measured directly. The applications of this instrument are very numerous, and it can be used for measurement of pintle motion by utilizing the movement of the pintle to vary the capacity of a small air dielectric condenser which is connected to the grid of an electrometer valve and simple amplifier. Measurement of flame travel is achieved by substituting suitably disposed sparking plugs for the pressure element and using the oscillograph to indicate ionization as the flame passes the plug points. Pressure waves in fuel lines are measured with the carbon pile indicator in a similar way to the cylinder pressures. A special pressure gauge for recording maximum compression and explosion pressures is also described. C. H. S.

1302. Estimation of the Combustion Products from the Cylinder of a Petrol Engine in Relation to Knock. A. Egerton, S. Ll. Smith and A. R. Ubbelohde. *Phil. Trans. Royal Soc.*, 1935, **A, 234**, 433–521.—A valve mechanism is described by which samples of gas were withdrawn from the zone of knock from the cylinder of a Delco knock-rating engine at various points during the cycle. Analyses of these gases using a modified Orsat apparatus (Egerton and Smith, *J. Sci. Instr.*, 1934, **11**, 28) and stroboscopic observations of the flame showed that some combustion occurred in the knocking zone, prior to the passage of the flame. Aldehydes and peroxides were detected and estimated in the combustion products by the "droplet" method of Egerton (*J.S.C.I.*, 1913, **32**, 331) using Schiff's reagent for aldehydes and acid aqueous potassium iodide for "peroxides." Maximum concentration of aldehydes (1 in 150) was attained at the moment the flame reached the sampling valve, whilst "peroxides" (oxidizing substances which react with potassium iodide) were also detected (about 1 in 10,000), but disappeared before the flame reached the valve. With increased "knock" the proportion of "peroxides" increased. No "peroxides" were detected when motor benzole was used as fuel. The addition of $PbEt_4$ to the gasoline decreased the amount of aldehydes and "peroxides" formed. Since the addition of aldehydes to the fuel had no appreciable effect on the amount of "peroxides" formed, the "peroxides" detected were not oxidation products of aldehydes. The latter did not appreciably

affect knock. "Peroxides" were not increased by the addition of hydrogen to the charge, although this gas had an anti-knock effect.

From tests made using pure fuels of known composition (H_2, CH_4, C_4H_{10}, C_5H_8, C_6H_{14}, etc.) it was concluded that the "peroxides" formed consist mainly of nitrogen peroxide. There is a pronounced peak in the peroxide curve, in general slightly before top dead centre, and it is shown that the apparent decrease in peroxides in the later stages of the combustion is due to inhibition of the liberation of iodine owing to the presence of sulphur dioxide derived from sulphur compounds present in the fuel (pure benzene, as distinct from motor benzole, gave peroxides), and to lack of sufficient oxygen in the burnt gases to combine with the nitric oxide. NO_2 may also be partly removed by unsaturated vapours. Added NO_2 did not induce knocking with a hydrocarbon fuel, although it did so with hydrogen, but the amount formed increased when knock occurred. The effect of pro-knocks such as amyl nitrite cannot therefore be due to liberated NO_2, but must be due to the organic radical. Insufficient evidence is available to indicate the source of the NO_2. Comparative tests using (1) sodium bisulphite and potassium cyanide/silver nitrate, (2) Schiff's reagent with and without sulphuric acid, showed that the aldehydes formed are mainly formaldehyde. This was confirmed by spectroscopic measurements. Very little organic acid could be detected.

A number of organic peroxides of the type which might occur as peroxidized products of hydrocarbons were prepared and their reactions with a number of reagents studied, particularly in the presence of NO_2. From experiments in which the peroxide was sprayed into the intake air, it was shown that diethyl and ethyl hydrogen peroxides are potent pro-knocks (1 part in 10^5), H_2O_2 has a slight pro-knock effect, but butyraldehyde peroxide and amylene peroxides do not appear to act as pro-knocks. Engine tests with *n*-hexane with a special technique for detecting organic peroxides indicate the presence of organic peroxides in the gases in the region of knock just prior to the passage of the flame. The vapours of potassium and thallium were much more effective than $PbEt_4$ in suppressing detonation. Thallium had no measurable anti-knock effect when introduced in a stream of nitrogen, and a previous conclusion is confirmed, that to be effective the anti-knock must be in an incipient state of oxidation and that it should be capable of being oxidized to a higher oxide. Vapours of selenium and tellurium were effective anti-knocks, but Na, Cd, Zn and I_2 were ineffective. The decomposition of $PbEt_4$, $Ni(CO)_4$ and $Fe(CO)_4$ was studied at various temperatures.

The relation between knock, ignition and the effect of anti-knock on ignition points is discussed, and it is suggested that knock is due to the sudden explosion of a pre-sensitized portion of the charge in an engine cylinder owing to a branch chain type of reaction among the substances formed by partial combustion. The apparent anomalous behaviour of organic peroxides, organic nitrites and NO_2 in raising the ignition point of hydrocarbons, although they do not act as anti-knocks, may be due to the production of other radicals which are essential to the propagation of chains, and which may give rise to branching of chains, and so to explosive ignition. The general character of hydrocarbon combustion is held to be consistent with the formation of products such as aldehyde peroxide, decomposition of which may give rise to the low ignition range. C. C.

1303. Effect of Tetraethyl-Lead on Preflame Reactions in an Engine. L. Withrow and G. M. Rassweiler. *Ind. Eng. Chem., Ind. Edn.*, 1935, **27** (8), 872–878.—A study of engine combustion is made by examination of the absorption spectra through the combustion chamber. Spectroscopic data are given which indicate that lead does influence preflame reactions and which show that atomic lead is present at the time anti-knock action is effected.

The spectra were photographed through two quartz windows on opposite sides of the combustion chamber of the engine and disposed at the end of the chamber furthest from the spark plug, so that the portion of the charge which knocked lay between them. Illumination was either by a carbon arc or an under-water spark, and the timing of the exposures was controlled by a stroboscopic disc driven from the crankshaft.

A series of photographs is given, taken before, during and after inflammation, and which show the effect on the continuous absorption spectra of a change from straight gasoline (knocking) to a leaded gasoline (non-knocking), the spectral region covered being from 2700 to 3400 Å. The timing of occurrence of knock was obtained from

indicator diagrams. These photographs show that the addition of sufficient lead tetraethyl to the fuel to remove knock decreased the continuous absorption in the region of 3000 Å., this effect being detected only just before the arrival of the flames in the knocking zone.

In the non-inflamed gas the atomic lead line at 2833 Å. was observed when lead was removing knock, but no trace of lead monoxide bands was observed. To obtain further information with regard to the absorption spectra of lead and lead monoxide, some experiments were carried out in nichrome and carbon tubes.

Owing to the complete absence of the lead monoxide bands in the engine spectra, the authors suggest that lead monoxide is reduced in the non-inflamed charge in the engine—that is it may be acting as an oxidizing agent at the moment the lead is effecting anti-knock action. J. G. W.

1304. Rapid Determination of Sulphur in Mineral Oil. I. S. Zelikov, A. N. Kotrelov and E. I. Fogelson. *Neft. Khoz.*, 1934, **26** (5), 58–59.—The Holthaus method used in steel is applied to sulphur determination in mineral oil. 0·1–0·15 gm. oil is placed in the boat of a Mars electric furnace and the combustion effected in a stream of dry oxygen, first at 450–650° C. and finally at 1000–1150° C. The solutions needed are (1) 100 ml. H_2O_2 (30%) diluted with water to 5 litres, (2) 6·81 ml. H_2SO_4 of 1·84 sp. gr. are diluted with water to 5 litres, (3) 10 gm. NaOH are dissolved in 5 litres and 0·85 gm. sodium alizarin sulphonate is introduced. The titre of the solutions is checked empirically with N steel. It is claimed that a sulphur determination by this method requires 20–25 minutes, and its accuracy is comparable to that of the Eschka determination.
For. Petr. Techn.

1305. Characteristics of Hydrocarbons. E. Galle, R. Klatt and W. Friedl. *Petr. Zeit.*, 11.9.35, **31** (36), 1–13.—Physical properties such as fluorescence, crystallization, and solvent action as aids to the detection and separation of paraffinic and naphthenic hydrocarbons are described in detail. Details of their determination are given.

1. *Fluorescence.* Differences in fluorescence were observed with various waxes, *e.g.* beeswax, Montan wax and petroleum products such as lubricating oil, petroleum ether, etc. Four hydrocarbons, namely, hexane, *cyclo*hexane, amylene and benzole, and a series of different benzene fractions from Pennsylvanian petroleum were investigated. These exhibited very small luminous effects except when treated with concentrated sulphuric acid, when a definite fluorescence was observed.

2. *Crystallization.* Waxes crystallized from petroleum ether could be differentiated, but no difference was observed between ultra-violet and daylight photomicrographs of the crystals separated. Benzole or *cyclo*hexane, when treated similarly and cooled slowly, showed the formation of star crystals which changed at varying rates into the needle form. The same crystal forms were obtained from *cyclo*hexane, but not with hexane because of the low solidification point.

3. *Action of Solvents.* The selective solvent action of chlorex for hexane, *cyclo*hexane, amylenes and benzole was investigated. All four solvents were miscible at room temperatures, but on intense cooling most of the solvent separated.

Mixtures of hexane and chlorex in different proportions were cooled. It was observed that on uniform cooling (— 10° to — 17° C.), the mixture separated into two layers, hexane usually constituting the upper layer and the separation being most effective when the solvents were mixed in the proportion of 1 : 1. The composition of the separated layers was determined by measurements of refraction. It was observed that at lower temperatures (— 80° C.), hexane constituted the upper layer and amylene remained in solution in sufficient excess of chlorex (3 vols. of chlorex : 1 vol. of amylene), even on strong cooling.

In the system hexane–*cyclo*hexane–chlorex, extensive separation occurred as with hexane. The upper layer contained a mixture of hexane–*cyclo*hexane, the latter being insoluble in chlorex, although it decreased the solubility of hexane in chlorex.

The solubilities of mixtures of hexane–amylene, of hexane–benzole and of amylene or benzole in chlorex were determined similarly. When a mixture of hexane, *cyclo*hexane and benzole was made with chlorex, then only the benzole dissolved in the chlorex. It was found impossible to determine the refractive index of the mixture of the four hydrocarbons.

In the case of a benzine fraction of boiling range 60–70° C. of low aromatic content and free from unsaturated hydrocarbons, the mixture with chlorex in the proportion

of 1 : 1 gave similar results to hexane on strong cooling. The benzine passed almost completely into the upper layer.

The results show that chlorex is suitable for the separation of paraffinic and naphthenic hydrocarbons from aromatic and unsaturated hydrocarbons, but a separation of paraffinic and naphthenic hydrocarbons is not effected.

Petroleum from Pennsylvanian crude oil and from Gbely crude oil, lubricating oil, etc., was also investigated using chlorex at different temperatures. On account of the complex composition of these substances, the chlorex content was determined in the separated layers analytically after previous saponification with 4 N. alcoholic caustic potash and subsequent titration of the chloride formed (Mohr's method). It was found that with increasing boiling range of the substances investigated the absorption of chlorex increased. W. S. E. C.

1306. Composition of Hard Paraffins obtained in the Benzine Synthesis of Fischer and Tropsch. H. Koch and G. Ibing. *Brenn.-Chem.*, 1935, **16**, 141–148.—Five to 10% of the paraffin hydrocarbons formed in the benzine synthesis are of m. p. in excess of summer temperature. Occurring partly in the high-boiling oil, and partly in the catalyst to an extent up to one and a half times its weight, a hard paraffin of m. p. 70–80° C. may be obtained by solvent extraction of the catalyst mass.

This hard paraffin has been subjected to an intensive separation based on extraction with various solvents and by distillation at 10^{-5} mm. mercury pressure.

By extraction with ether, varying proportions of soluble and insoluble constituents were obtained of minimum and maximum m. p., 40° and 106° C., respectively. The insoluble paraffins were re-extracted with dichloroethylene, leading to products of minimum and maximum m. p. 88° C. and 108° C., and the insoluble residues obtained from the dichloroethylene extraction, or extraction with chloroform for some 200 hours, yielded residual waxes of m. p. 112–113° and 113–114° C. These subjected to renewed extraction with chloroform for 187 hours resulted in residues of m. p. 113–114·5° and 115·5–116·5° C., and molecular weights 1750, 2140, respectively. The authors conclude that m. p. increases similarly to the carbon–hydrogen ratio, and that no paraffins have a higher m. p. than about 118° C.

The residues resulting from chloroform extraction represent the highest members of the paraffin hydrocarbon series yet prepared, and contain 100–150 C atoms. Precipitated from hot benzole solution by alcohol as a white powder, after melting and solidification they are not scratched by the finger-nail. The sp. gr. is high, ranging from 0·938 for the lowest m. p. residue from ether extraction to 0·965 for the highest m. p. residue from chloroform extraction.

Repeated high vacuum distillation at 10^{-5} mm. Hg pressure of the ether–insoluble residue and fractions therefrom failed to yield individual hydrocarbons, but from the regularity of the results it was concluded that the compounds present were *n*-paraffins with perhaps some *iso*paraffins, of molecular formula $C_{70}H_{142}$ to about $C_{150}H_{302}$. B. C. A.

1307. Reactions of Paraffins with Olefins. V. N. Ipatieff and A. V. Grosse. *J.A.C.S.*, 1935, **57**, 1616–1621.—The general reaction consists in the direct addition of an olefin to a paraffin according to the equation,

$$C_mH_{2m+2} + C_nH_{2n} = \underset{+}{\underset{\text{Catalyst}}{C_{m+n}H_{2(m+n)+2}}}$$

and, for example,

$$i\text{-butane} + \text{ethylene} = 2 : 2\text{-dimethylbutane}.$$

Aluminium chloride and boron fluoride were the most extensively studied agents for this alkylation, and conditions must be carefully controlled in order to allow the reactions to proceed quantitatively and smoothly, and to avoid complicating side reactions and further alkylations to higher paraffins. Boron fluoride appears to be the more suitable catalyst.

The action of the catalyst (BF_3) on olefins alone and on paraffins alone, as well as on mixtures, is described. The alkylation of the paraffins in admixture with olefins takes place at temperatures as high as 200° C., although temperatures of 10–30° C. are preferable. Pressures of 5–20 atmospheres are used. Finely-divided metallic nickel and small quantities of water are necessary to supplement the gaseous BF_3 in

effecting reaction. Experimental details and a diagram of the apparatus are given. All the paraffins alkylated contained a tertiary carbon atom, as *n*-paraffins are not successfully alkylated using BF_3 catalysts. Aluminium, zirconium and other metal halides, however, will alkylate *n*-paraffins. W. E. J. B.

1308. Concentration of Ethylene. O. Pipik. *For. Petr. Techn.*, 1934, **2** (9), 348.—An ethylene fraction from cracked gases was concentrated by passage through activated carbon under certain temperature conditions—thus fractions contained 2, 4, 17 and 25% ethylene were concentrated to 17, 21, 40 and 55%. The ethylene concentrate was removed from the activated carbon by steam or gases having a higher affinity for activated carbon than ethylene. G. R. N.

1309. Reaction of Naphthenic Hydrocarbons with Olefins. V. N. Ipatieff, V. I. Komarewsky and A. V. Grosse. *J.A.C.S.*, 1935, **57**, 1722–1724.—The reaction between naphthenes and olefins in the presence of aluminium chloride or boron fluoride takes place at 50–75° C. under atmospheric or superatmospheric pressure (5–15 atm.). The alkylation of the naphthenes occurs according to the general equation :

$$C_mH_{2m} + C_nH_{2n} \xrightarrow{\text{Catalyst}} C_mH_{2m-1} \cdot C_nH_{2n+1} \text{ or } C_{m+n}H_{2(m+n)}$$

A typical experiment described is that of the alkylation of *cyclo*hexane with ethylene, in the presence of aluminium chloride, to yield di- and tetra-methyl*cyclo*hexanes. Boron fluoride seems to be more selective in its action than aluminium chloride. The former, however, will readily catalyse the alkylation of naphthenes containing tertiary carbon atoms, *e.g.* methyl*cyclo*pentane. Experimental details are given. W. E. J. B.

1310. Preparation of Certain Alkenes, Alkadienes and Alkines. S. P. Mulliken, R. L. Wakeman and H. T. Gerry. *J.A.C.S.*, 1935, **57**, 1605–1607.—The preparation of alkenes from the Grignard reagent and unsaturated halides has been extended to the use of 4-bromo-2-pentene. The paper contains constants for nine substituted alkenes, six dienes and six alkines. W. E. J. B.

1311. Condensation of Propylene with Aromatic Hydrocarbons. S. J. Slanina, F. J. Sowa and J. A. Nieuwland. *J.A.C.S.*, 1935, **57**, 1547–1549.—The condensation of propylene with benzene in the presence of boron fluoride and various condensation accelerators is described. Of the latter, sulphuric acid was very effective and mono-, di-, tri- and tetra-*iso*propyl derivatives of benzene were prepared. The conditions of experiment are given for controlling the relative amounts of the various derivatives which are produced. Other olefins and cyclic compounds can be used. W. E. J. B.

1312. Acidic Constituents of a West Texas Pressure Distillate. M. Williams and G. H. Richter. *J.A.C.S.*, 1935, **57**, 1686–1688.—A sample of commercial naphthenic acids from the alkali wash of a Dubbs pressure distillate was investigated. The charging stock to the cracking unit was the gas oil portion of a West Texas crude. The method of examination is described fully. In brief, the crude acids were dissolved in dilute caustic soda and steam distilled. The distillate was examined, whilst the non-volatile residue was treated with sulphuric acid and the liberated organic acids were converted into methyl esters. These impure esters, treated with sodium hydroxide, separated into alkali soluble phenols and semi-pure esters. The esters were examined, purified and hydrolysed to yield the corresponding acids which were obtained and fractionated.

For the most part, the pressure distillate consisted of phenolic compounds. The following were isolated : phenol, *o*-cresol, *m*-cresol, *p*-cresol, 1 : 3 : 5-xylenol, 1 : 4 : 2-xylenol as well as ethyl mercaptan. Acids found were *iso*-valeric, *n*-heptylic, *n*-octylic and *n*-nonylic.

No cyclic acids were found, and doubt is cast on previous work which reported the presence of cyclic compounds exclusively. W. E. J. B.

1313. Cracking and Polymerization of Low Molecular Weight Hydrocarbons. K. Frolich and P. J. Wiezevich. *Ind. Eng. Chem.*, 1935, **27**, 1055.—The thermal decomposition reactions of the lower paraffins, olefine and acetylene are reviewed from the point of view of maximum olefine and liquid fuel production. Polymerization is also reviewed. In the case of propane, thermal treatment at 880° C. gives a yield of 1·52 gal. per 1000 cu. ft. By a two-stage process in which propane is first of all cracked to olefines at 840° C., and the olefines then polymerized at 650° C. and 700 lb. pressure, the yield is 1·29 gal. per 1000 cu. ft. By the use of a two-stage process with intermediate hydrogen removed, the yield is increased to 5·73 gal. per 1000 cu. ft.

D. A. H.

1314. Pyrolysis and Polymerization of Gaseous Paraffins and Olefines. F. W. Sullivan, R. F. Ruthruff and W. E. Kuentzel. *Ind. Eng. Chem.*, 1935, **27**, 1072.—Results obtained in the pyrolysis of ethane and propane in a helical coil of KA2S tubing are detailed. Contact times of 0·5–2·6 seconds were employed in the temperature range 1440–1550° F. (782–843° C.). The reaction space was 15·4 cu. in. (= 252 c.c.). In the absence of secondary reactions, the volume increase on pyrolysis should be numerically equal to the volume yield of olefines, and the deviation of experimental results from the theoretical curve is quite small, but increases with increasing conversion. Temperature, per cent. conversion, and time of contact *per se* have little effect on the course of the reaction. The greatest olefine concentration in the exit gas (39%) is obtained by operating at the highest temperatures with very short times of contact. Under optimum conditions, the vol.-% conversions of ethane and propane to olefines were 74 and 82, respectively. On increasing time of contact beyond that necessary for optimum results, the olefine content of the cracked gas and the olefine yield both decrease because of secondary reactions which cause destruction of the olefines.

Experiments on non-catalytic polymerization of olefines are also described. At 500 lb. pressure, ethylene gives an optimum yield of 59% by weight of polymers at 455° C. (850° F.) and 8 minutes contact time. The polymers have gravities about 52° A.P.I., contain 75–80% gasoline with octane numbers of 74–78 (C.F.R. Research Method). At 1000 lb. pressure, the maximum liquid yield of 70% was obtained at 850° F. (455° C.) with a time of contact of 27 minutes. The highest yield from ethylene (81%) was obtained at 850° F., 2000 lb. pressure and 22·4 minutes contact time.

Propylene was found to polymerize to a smaller extent than ethylene under the same reaction conditions, but gave products of higher octane number (C.F.R. Research Method).

D. A. H.

1315. High-Temperature Pyrolysis of Gaseous Paraffin Hydrocarbons. H. Tropsch and G. Egloff. *Ind. Eng. Chem.*, 1935, **27**, 1063.—Experiments on the pyrolysis of gaseous paraffin in 3 mm. I.D. Pythagoras tubes at 1100–1400° C. and at 50 mm. pressure are described in detail. The pyrolysis of ethane, propane and *n*-butane with varying contact time proceeded in a similar manner at 1100° C., but the reactions take a different course in the case of *iso*butane. Methane is much more stable than the higher paraffins. Acetylene formation was appreciable in all the reaction conditions examined, and increased with increase in reaction time. Carbon formation was found to increase at a rate directly proportional to the logarithmic increase in contact time.

D. A. H.

1316. Catalytic Polymerization of Gaseous Olefines by Liquid Phosphoric Acid. I. Propylene. V. N. Ipatieff. **II. Butylenes.** V. N. Ipatieff and B. B. Corson. *Ind. Eng. Chem.*, 1935, **27**, 1067–1071.—Liquid orthophosphoric acid is an effective catalyst for the polymerization of propylene and butylenes at ordinary or superatmospheric pressure and at temperatures as low as 130° C. Evidence is produced to show that polymerization occurs through the intermediate formation of alkyl phosphoric esters.

Under moderate polymerizing conditions (135–200° C. and 1–15 atm. pressure) propylene polymerizes to a liquid consisting almost entirely of mono-olefines of iso-structure, which is practically 100% soluble in 96% sulphuric acid at 0° C., and which distils from 40° to 230° C. with very little bottoms. Under more severe polymerizing conditions, the polymerization reaction is followed by other reactions, and the liquid product contains not only olefines, but also naphthenes, paraffins and aromatics.

By contacting propylene at 125° C. with 20% orthophosphoric acid and 10 atm. pressure, a homogeneous liquid was obtained which on further heating separated into

two layers, the upper of which consisted of polymers and the lower was phosphoric acid which was capable of polymerizing additional propylene. By treating ethylene in the same way and neutralizing the homogeneous liquid with barium hydroxide, a barium salt was obtained, the analysis of which agreed very well with that of the barium salt of mono-ethyl phosphoric acid.

n-Butylenes were found to exert an accelerating effect on the polymerization of propylene, and *iso*butylene was observed to have the same accelerating effect on the polymerization of the *n*-butylenes. By the polymerization of olefine mixtures, mixed polymers were obtained.

The higher the polymerization temperature the more complex the product.

D. A. H.

1317. Thermal Decomposition of Normal Pentane. J. J. Morgan and J. G. Munday. *Ind. Eng. Chem.*, 1935, **27**, 1082.—Experiments are described in which *n*-pentane, both alone and admixed with steam, have been submitted to thermal decomposition in the absence of catalysts in silica reaction chambers. The gaseous products have been fully analysed by standard methods of Podbielniak low-temperature distillation, absorption and combustion. In all the experiments, the time of contact in the reaction chamber was 10 seconds, ignoring the increase in volume due to reaction. The reaction chamber was 79 ml. capacity.

At 600° C. the rate of decomposition of *n*-pentane is independent of concentration over the range from one to one-sixth atmosphere pressure. This indicates that the primary decomposition is essentially a first-order reaction. At the same temperature and at partial pressures below atmospheric, the proportions of methane, propylene, propane and butene-1 are not affected by change in partial pressures. On the other hand, an increase in steam concentration decreases the amount of ethane formed, whilst the amounts of ethylene and hydrogen produced decrease.

The reactions involved are:

$$C_5H_{12} \longrightarrow C_2H_4 + C_3H_4 + CH_4$$
$$C_5H_{12} \longrightarrow C_3H_6 + C_2H_6 \text{ (or } C_2H_4 + H_2)$$
$$C_5H_{12} \longrightarrow C_4H_8 + CH_4$$
$$C_5H_{12} \longrightarrow C_3H_8 + C_2H_4$$

At higher temperatures the decrease in ethane formed and increase in ethylene formed on dilution with steam is also marked. The evidence of the formation of 1 : 3-butadiene at 700–800° C., and dilution with steam, appears to favour the formation of acetylene. D. A. H.

1318. Determination of Water. E. Migray. *Ind. Eng. Chem. Anal.* 1935, **7** (5), 348.—This method is an extension of the distillation method, and water contents of only a few tenths per cent. can be determined accurately. It consists of distillation of the material with xylene or toluene, dehydration of the distillate with a weighed quantity of anhydrous copper sulphate, filtration and washing of the copper sulphate with benzene and ether. On drying the copper sulphate *in vacuo*, the amount of water is calculated from the increase in weight of the copper sulphate. The method is applicable to the determination of water in any product which loses its water at 110–140° C. and yields no other volatile compounds that act on copper sulphate. A table of results is appended to demonstrate the flexibility of the method. R. E. D.

1319. Reflux Regulator for Laboratory Stills. J. H. Brunn. *Ind. Eng. Chem. Anal.*, 1935, **7** (5), 359–360.—A diagram and description of the apparatus are given, and the following are the essential points. Vapours pass from the column to a reflux condenser; the hot liquid passes from here down into a capillary above a dividing chamber. The flow of liquid from this is carefully controlled by means of a micrometric screw to return to the top of the column through a capillary or through another similar capillary as distillate. Two vertical tubes are connected to the dividing chamber, and the last-mentioned capillary tubes and the hydrostatic heads in these are proportional to the flow of liquid in both directions. Thus the numerical value of the reflux ratio during a distillation is the ratio of the heights of liquid in the two tubes.

A more practical arrangement of the above principles is given in another diagram which incorporates a small heating box for the flux capillaries. R. E. D.

1320. Apparatus for the Study of Liquid–Vapour Equilibrium Compositions. R. M. Wiley and E. H. Harder. *Ind. Eng. Chem. Anal.*, 1935, **7** (5), 350.—The apparatus,

which has been used for the design of plant-size fractionating towers, consists of a three-neck flask with the following fitments: (1) a thermometer for observation of temperature of liquid; (2) a sampling tube for the liquid; (3) a glass cup serving as a reflux container (provided with a variable leak), to which is attached a reflux condenser and a sampling tube; (4) a thermometer for observing the temperature of the vapour.

The flask is immersed in glycerol and the liquid is boiled gently. The condensed vapour in the cup is maintained at a constant level by controlling the rate of boiling and the rate of leakage from the cup. When both thermometers have remained constant for some time, samples from the cup and flask are taken. The composition is charged by adding more of one component through the condenser. R. E. D.

1321. Determination of Dry-Cleaning Soaps in Petroleum Solvents. Marshall. *Oil & Col. Trades J.*, 1935, **88**, 346 (From *J. Soc. Dyers & Cols.*, 1935, 241).—Standard solutions for the titration of soap solutions in non-aqueous media, *e.g.* soap in white spirit, are made, using hydrochloric acid or caustic potash dissolved in a mixture of white spirit and *n*-butyl alcohol. The soap solution is first titrated with alkali using phenolphthalein to give free fatty acid content, and then the total soap is obtained, using one of the following indicators:—(*a*) eosine + xylene cyanol FF in methylated spirit and *n*-butyl alcohol; (*b*) eosine and malachite green in *n*-butyl alcohol; (*c*) fluorescein, eosine and xylene cyanol FF in methyl alcohol and *n*-butyl alcohol. C. C.

1322. Analysis of Benzoles. W. J. Gooderham. *J.S.C.I.*, 1935, **54**, 297T–301T.—A vacuum-jacketed Dufton fractionating column has been used for determining the vol.-% of benzene, toluene and xylenes in benzoles. Only a small amount of the latter is required for test, *e.g.* 20 ml. It is mixed with a little tetrahydronaphthalene and introduced into the top of the fractionating column, and passes down to a small electrically heated container. The temperature, obtained by a thermocouple, is taken for every 0·1 ml. distillate. Corrections are applied for the gas evolved. The lengths of the flat portions on the distillate–temperature graphs correspond roughly to the true amounts of the individual aromatics present. The apparatus is also applicable to the fractionation of wash oils and other liquids containing only a small amount of one constituent. In such cases a large electrically heated flask is used. The proportion of saturated, unsaturated and aromatic hydrocarbons in a benzole is obtained by a modification of the Manning–Shepherd Method, in which the benzole vapour mixed with air is passed through a nitrating mixture, soda lime and calcium chloride. Unsaturateds are oxidized to carbon dioxide, water and products soluble in water or caustic soda; aromatics are nitrated and the nitro-compounds extracted and weighed. If the benzole contains a high proportion of unsaturateds, the vapours are first extracted with 70% sulphuric acid to remove the bulk of the unsaturateds. C. C.

1323. Advances in the Investigation and Evaluation of Light Fuels. H. Schildwächter and H. Martin. *Brenn.-Chem.*, 1935, **16**, 301–309.—A review of present knowledge and investigational methods for fuels, in respect to composition, gum content, boiling point, sulphur and water contents, and knock values, with an appendix of 163 references to the literature. B. C. A.

1324. Octane Numbers of Russian Gasolines. T. M. Kligerman. *Azerb. Neft. Khoz.*, 1933, **6–7**, 33–37.—The following octane numbers of Russian gasolines are typical: straight Baku 73–75 (30% at 100° C.), cracked Baku 78–81, cracked Baku naphtha 64–67, Grozny "Naturalin" 68, Grozny light gasoline (NN) 55–57, Grozny heavy gasoline (NN) 48–50, Grozny cracked gasoline 71–73, Grozny aviation (NN) 61, Maikop light gasoline 66 (45% at 100° C.). G. R. N.

1325. Laboratory Testing of Lubricants. F. J. Slee. *J.S.C.I.*, 1935, **54**, 809–814.—The article opens with a general discussion of the significance of the tests most commonly applied to lubricants. It is emphasized that specific gravity is no longer indicative of the source and quality of oils since the advent of solvent refining, and is now useful only for re-identification purposes, *e.g.*, to deliveries under contracts. Similarly, flash point is no true guide to volatility, but is useful particularly in the case of steam cylinder oils, for ensuring freedom from contamination from light fractions, and also for re-identification purposes. Regarding viscosity, the importance is stressed of correct viscosity at the appropriate temperature, and of the viscosity–temperature

relationship in certain specific instances—such as crank-case lubricants. Under the heading "saponifiable matter," the merits and demerits of compounding are broadly discussed, and it is pointed out that tarry impurities sometimes found in badly scrubbed gas are more soluble in fatty oils. The selection of lubricants for specific purposes is dealt with, such as shafting, general machinery, steam turbines and internal-combustion engines, and useful figures to serve as guides are quoted. The article concludes with a note of warning about the application of the British Air Ministry Oxidation Test to oils of low viscosity and pronounced volatility. J. L. T.

1326. Composition of the Lubricating Oils Prepared from Kogasin II. H. Koch and G. Ibing. *Brenn.-Chem.*, 1935, **16**, 261–268.—Individual alkyl chlorides prepared from synthetic diesel oil (Kogasin II) were condensed to lubricating oils by two methods: (1) condensation alone in the presence of activated aluminium, and (2) condensation with aromatic hydrocarbons in the presence of aluminium chloride.

In the first case the reaction appears to be due to the progressive formation of aluminium chloride, and follows three directions, viz., first, cracking, resulting in the production of some 8% of low-boiling hydrocarbons, secondly, hydrochloric acid elimination leading to the production of the original hydrocarbon by intermolecular change, and thirdly, polymerization incorporating the formation of one double linkage and 1 : 2-naphthene rings.

Condensations with aromatic hydrocarbons—benzole and xylol were performed using, mono-, di- and poly-chloroalkyls. The lubricating-oil residues separated by fractional distillation are essentially of three types, the first formed by the condensation of 2 mols. of alkyl chloride, and characterized by a high hydrogen content (13·5–14·0%), a density of about 0·85 and a flat viscosity–temperature curve. The second type originated by the condensation of 1 mol. of alkyl chloride with several aromatic rings, and have a low hydrogen content (less than 12·0%), a density of 0·90–0·95 and a high viscosity.

A third class is formed by the reaction of several molecules of alkyl chloride, intramolecularly and with aromatic hydrocarbons yielding oils which are more paraffinic in type than the second class. B. C. A.

1327. Classification of Lubricating Oils. E. Neyman. *Petr. Zeit.*, 11.9.35, **31** (36); *Motorenbetrieb.*, **8** (9), 1–6.—In the work described it is shown that the quotient of mol. wt. and density represents a definite criterion for lubricating oils and is a means of classification for these products.

The viscosities of several hydrocarbon oils of the same hydrocarbon class were determined, and it was found that the viscosity increases with increasing mol. wt. The observed influence of mol. wt. on the viscosity/temperature curve was obtained from the following formula: $W^{12} = Mv_2/d(v_1 - v_2)$, where M represents the mol. wt., d the density, v_1, v_2 viscosity in centistokes at temperatures t_1, t_2, respectively. A characteristic value is obtained dependent only on the mol. wt., density and viscosity investigated at two temperatures; no complicated calculations are involved. Other appropriate comparison temperatures are applied for lighter oils.

M. Freund calculated the mean temperature coefficient of viscosity for a number of oils utilizing one temperature interval. The dependence of this value on temperature and on mol. wt. signifies association of the molecules at low-temperatures for non-paraffinic oils and those oils of paraffin-base only possess a small tendency to form macromolecules. W. S. E. C.

1328. Comparison of Acid and Earth in Lubricating Oil Refining. M. Blagodarov and V. Litvinchuk. *For. Petr. Techn.*, 1934, **2** (9), 352–353.—The following conclusions (from experiments) were derived: (1) Acid treatment cannot be entirely substituted by earth treatment when refining Baku oils; (2) the degree of replacing the acid with clay may be determined by the effect exerted by clay which would correspond to 1% acid; (3) this equivalent is a variable, and is in direct proportion to the resin content of the stock and the degree of decoloration of the latter to be obtained, and is in inverse proportion to the intensity of the preliminary acid treatment; (4) by decreasing the consumption of the acid and increasing correspondingly the amount of clay, and considering the relationship discussed in (3), it is not advisable to exceed certain limits below which the acid cannot be substituted with clay. These limits are not identical for various oils, and they are determined on the basis of equivalents.

G. R. N.

1329. Quality of Waste Cylinder Oil. R. Yamasaki and H. Noro. *J.S.C.I.*, 1935, **54**, 808–809.—The properties are given of used oils, withdrawn at intervals during a 640-km. run, from the crank-cases of two engines. J. L. T.

1330. Utility of Physical Constants for the Estimation of the Ignition Quality of Diesel Oils. R. Heinze and M. Marder. *Brenn.-Chem.*, 1935, **6**, 286–289.—It has been established that several physical constants, including the parachor, sp. gr., and refractive index, stand in smooth relationship to the cetene number as determined practically, of a diesel fuel, of a given middle b. p., and on this basis a method has been developed for the determination of cetene numbers by calculation from the physical constants.

For this purpose the middle b. p. and one of the constants mentioned are determined. From diagrams supplied the cetene number corresponding to a fuel having the same value for the given physical constant as the sample, but of 50% b. p., 290° C., is deduced. By means of a straight-line formula supplied, a correction dependent on the difference between the actual 50% b. p. and 290° C. is applied.

The best correlation between this method and engine evaluation is obtained when using the parachor values. B. C. A.

1331. Analysis of Bitumen and Tar Mineral Mixtures. H. Nüssel and H. Henneke. *Bitumen*, 1935, **7**, 143–149.—In the extraction of the binder from bitumen–mineral mixtures it is often impossible to estimate the constituents quantitatively owing to the presence of insoluble organic matter from natural asphalt or asphaltic bitumens or "free carbon" from tar. A method is therefore described which depends on the estimation of carbon in the extracted mineral matter by treating the latter, in a finely-divided state, first with dilute hydrochloric acid and then with chromosulphuric acid and absorbing the carbon dioxide. As a result of experimental work, a factor has been derived by means of which the "free carbon" content or insoluble organic matter may be calculated from the carbon content of the mixture, since the insoluble compounds do not consist of pure carbon. Full details of the method and results are given. A. O.

1332. Testing of Asphaltic Rock and Bitumen–Mineral Mixtures. E. Klapper. *Asphalt u. Teer*, 1935, **35**, 705–708.—Tests used in the laboratory of the Road Research Institute, Milan, are described. Bitumen and aggregate are separated using carbon disulphide as solvent. The specific gravity of the bituminous mixture is calculated from $P = 100/\left(\frac{a}{b} + \frac{(100 - a)}{c}\right)$, where a = wt. % bitumen, and b and c = sp. gr. of bitumen and mineral, respectively. c is determined by the apparatus designed by Le Chatelier for testing cement. The durability of the product is investigated by repeatedly dropping a sphere of specified size and weight from a fixed height on the middle of a plate of the product—supported horizontally on two narrow ridges. In the same connection, the bending moment and breaking strength are measured by means of a loaded lever. For measuring plasticity, a definite weight is allowed to fall from a height of 1 m. on to a steel ball placed on a plate of the specimen. The impression made by the steel ball is recorded by inserting white paper and carbon paper between the ball and plate. The stability of the material (*i.e.*, resistance to flow) is measured by the method of Hubbard. C. C.

1333. Patents on Analysis and Testing. H. W. Howes. E.P. 433,770, 20.8.35. A Young and Thomas fractionating column, formed in sections which are fitted together by means of interchangeable ground joints.

Asiatic Petm. Co. E.P. 433,979, 23.8.35. Apparatus for analysing gases. It comprises a chamber containing a solid reagent for removing components to be determined quantitatively. A ball, fitting with a small clearance within the chamber, is used to cause the gas mixture to pass through the reagent chamber. A vacuum gauge is provided for measuring the reduction in pressure caused by the removal of the component to be estimated. The ball is moved by tilting the apparatus.

A. Gemont and R. V. Southwell. E.P. 434,994, 12.9.35. A U-tube viscometer in which pressure is applied to a column of liquid (Hg) in a second U-tube in such a way as to produce oscillations, the characteristics of which are observed. W. H. T.

Class 600. Refining and Refineries.

1334. Evaluation of Liquid–Liquid Heat Exchangers. T. W. Evans. *Ind. Eng. Chem.*, 1935, **27**, 1212.—An equation is deduced which gives the maximum temperature change which can be obtained when cooling a fixed quantity of one material with successive small amounts of a second material. This gives the minimum amount of the second material necessary to produce a given temperature change. The ratio of the minimum amount to that actually necessary may be taken as a measure of the efficiency of a cooling or heating coil immersed in a batch of the first liquid.

The case of two liquids moving countercurrent to each other is also treated, and an expression deduced connecting the temperature change with the number of ideal heat exchange units necessary to bring it about. The relation between the number of ideal units and the total surface and transfer coefficient has been obtained by combining the equation deduced here with that given by Seigle (*Rev. Ind. Min.*, 1925, 349–374) for heat exchangers of this type. P. D.

1335. Cracking. K. G. Schultz. *Angew. Chem.*, 1935, 567.—In discussing the principles of cracking, the author states that three processes are involved: disintegration into lower-boiling constituents; isomerization (of secondary importance); polymerization (undesirable and avoidable by high-pressure hydrogenation).

Referring to the work of Francis on thermodynamic stabilities and to that of Parks-Hoffmann on free energy of some organic compounds, stability diagrams were prepared which enable the different equilibrium processes and their relation to the temperature variations to be distinguished. Cracking reactions often yield temperature-stable compounds.

Primary decomposition takes place according to the formula $C_{m+n}H_{2(m+n)+2} \longrightarrow C_{m+n}H_{2m+2} + C_nH_{2n}$, ($m$ less than n). Hydrogen is derived from naphthene dehydrogenation and aromatic condensation. Rising temperatures increase the stability of aromatics, naphthenes holding an intermediate position between aromatics and aliphatics and olefines.

Destructive hydrogenation should be conducted at as low a temperature as possible, aided by temperature-reducing catalysts under high pressure. The latter prevents inversion of the reactions and promotes reactions in the sense of true hydrogenation. L. S.

1336. Production in the Coke Ovens of Oils and Tars from Coal. G. E. Foxwell. *Gas W.*, 1935, **103** (2666), Coking Section, 89–92.—This paper deals at length with the various factors affecting the production of oils and tars from bituminous coal. The following points are discussed very fully: (1) temperature, (2) the path of travel of the gases through the charge in the oven, (3) decomposition, (4) effect of free space above the charge, and (5) reasons are given for increased yields, discussing the effect of the Goldschmidt channel. Various tables are given describing the effects of time and temperature on the production of tars and gases. W. A. W.

1337. Destructive Hydrogenation of Naphthalene. I. I. Eru. *For. Petr. Techn.*, 1934, **2**, 11, 414.—Naphthalene was hydrogenated at 500° C., 100 atm. cold hydrogen pressure, in the presence of 2% MoS_2 and 2·5–3% sulphur or in the presence of WO_3 yielding 70–75% of liquid hydrocarbons. By varying the temperature of hydrogenation, the yield of fractions boiling below 100° C. and 100–180° C. may be varied. The distillate boiling below 180° C. was 80% and 50% of the hydrogenated and initial stocks, respectively, and consisted almost entirely of mono-substituted aromatics. G. R. N.

1338. Polymerization—A New Source of Gasoline. V. N. Ipatieff, B. B. Corson and G. Egloff. *Ind. Eng. Chem.*, 1935, **27**, 1077.—A catalytic polymerization process has been developed for the production of 81 octane number gasoline from cracked gases. Operating conditions of 230° C. (446° F.) and 200 lb. pressure have been found satisfactory with a catalyst described as a hard, grey to white granular non-corrosive solid, not poisoned by carbon monoxide, hydrogen sulphide or mercaptans. Regeneration is effected by air oxidation which removes high-boiling polymers from the catalyst. Cracked gases containing 17·6, 37·5, 43·1 and 69·7% by volume of propylene and butylenes give gasoline yields of 3·3, 6·0, 6·8 and 10·9 gal. per 1000 cu. ft. of gas processed, respectively. Gas throughput rates of 0·3–3·7 cu. ft. per lb. of catalyst per

hour have been employed, and conversions of olefines to polymers of 99% have been realized. A commercial plant is in operation. D. A. H.

1339. Preservation of Oil Products. Anon. *Chem. Trade J.*, 1935, **97**, 25, 49, 69, 115, 133.—The importance of "anti-oxidants" or stabilizers in the petroleum industry in connection with cracked gasoline and lubricating oil, and in the rubber, paint and soap industries, is briefly outlined. Reference is made to the literature regarding α-naphthol for stabilizing cracked gasoline, tri-cresol for benzole and other spirits produced from coal by high-temperature distillation and to pyrogallol, α-naphthol, *p*-methylaminophenol and *p*-benzylaminophenol for low-temperature spirits. Discrepancies in observation of different investigators using the same inhibitor are probably due to inherent instability of the products studied and the presence of natural inhibitors or accelerators in the gasoline. Thus, Vellinger and Radulesco found that a fraction of an unrefined cracked gasoline could be used as anti-oxidant, and minute traces of acidic bodies have sometimes a pronounced accelerating effect in gumming and resinification. Various methods employed for ascertaining the gum-forming tendencies of gasoline and effectiveness of inhibitors are described. According to Egloff, the moderate inhibiting action of phenol is intensified by the introduction of alkyl groups into the molecule, particularly in the *o* and *p* positions. Two alkyl groups usually produce an inhibitor with more than twice the power of the mono-alkyl phenol. With the four dimethyl phenols the *p* and *o* positions are the most effective. Phenolic bodies may naturally be present in benzoles and cracked gasolines, and since there is an optimum percentage of inhibitor for best results, allowance must be made for natural inhibitors or their removal effected.

Pyrogallol and hydroquinone are excellent inhibitors, but their relatively high solubility in water compared with solubility in petroleum products is a drawback. Alkyl-substituted pyrogallols and amylated hydroquinone are improvements in this respect. Pyrogallol mono-alkyl ethers and similar compounds are also gum inhibitors. Quinhydrone has been recently proposed as an effective gasoline inhibitor. Certain hydroxynaphthalenes are effective inhibitors for gasoline, benzole, diesel oil and transformer oils. Other effective naphthol products are mentioned. Certain substituted amino-products are effective colour and gum stabilizers, mostly covered by patents, which are listed. Mardles and Helmore have found that by reducing the basic character of compounds belonging to the types $RNH{\cdot}NH_2$ and RNH, inhibitors which are effective when used in concentrations up to 0·05% are produced. Many well-known photographic developers make good inhibitors, especially the amino-phenols. *Para* derivatives are the most active, and *p*-benzylaminophenol possesses the important advantage of being comparatively soluble (0·2%) in cracked gasoline. Other useful related inhibitors are *p*-hydroxyphenyl glycine and *p*-hydroxyanilido-acetonitriles.

Sulphur and most sulphur compounds, such as mercaptans, are accelerators, but certain amines are effective inhibitors. Some dyestuffs, including indophenols (blues and reds), oxazines and indamines (greens and blues), and eurhodines and suframines (reds), are useful inhibitors in proportion of 1 part in 10,000 to 20,000 parts. Since this is about ten times the strength required for suitable colourings, their use in conjunction with a colourless inhibitor, preferably light-stable to prevent fading, has been proposed. Efficiencies of various petrol-soluble dyes reported by Egloff are quoted, and show that the introduction of azo- and nitro-groups adversely affect inhibitor activity.

Lubrication should provide a fertile field for the beneficial application of anti-oxidants. The use of less than 0·5% of a hydroxydiphenyl to stabilize cylinder oils, transformer oils and mineral greases has been patented. Diamines, *e.g.*, ethylene diphenyldiamine, have been suggested for engine oils, etc., and also the more weakly basic compounds proposed by Mardles and Helmore for use in gasolines. Other products proposed for this purpose are T.E.L., various tin compounds and chromium oleate.

The investigations of Mead and of Yomada on stabilization of transformer oils are summarized. The latter found tin naphthenate particularly effective, and the Standard Oil Development Co. have patented the use of organo-metallic lead and tin compounds for non-sludging oils. The use of aromatic compounds consisting of carbon, hydrogen and sulphur only (or selenium or tellurium), particularly aromatic disulphides and mercaptans boiling above 150° C., has recently been patented for

lubricating oils, especially solvent extracted. Other products proposed as lubricating or transformer oil stabilizers are rubber "age-resistors" (*e.g.* α-naphthylpiperidine) hydroquinone, certain phenolates and hydroglyoxaline derivatives.

Phenyl-α-naphthylamine (0·5%) is able to retard oxidation in paraffin wax during several months at 150° C. Maleic acid and other polybasic unsaturated aliphatic acids, also saturated hydroxypolybasic acids such as citric, and the salts and esters of these acids are useful for improving the keeping qualities of fats and fatty products. Other fat, fatty oil and soap stabilizers are referred to. R. A. E.

1340. Oxidation. L. Andrussow. *Angew. Chem.*, 1935, 593.—The theory of the catalytic oxidation of NH_3–CH_4 mixtures to hydrocyanic acid (D.R.P. 549,055) is discussed. L. S.

1341. Treatment of Cracked Gasoline with Solid Zinc Chloride. Strom and Mil'shin. *For. Petr. Techn.*, 1934, **2** (9), 349.—A Vicker's cracked gasoline when treated with solid zinc chloride on a semi-commercial scale gave a refined product that did not require redistillation and acid treatment. It was still unchanged after 5 months' storage. The gasoline losses were small, and the polymers formed were suitable for use in the lacquer industry. The zinc chloride loss after two recoveries was 0·154%. G. R. N.

1342. Vapour Recovery and Pressure Distillate Depropanizer. R. H. Turner. *Petr. Eng.*, July 1935, **6** (11), 95.—A description is given of a combined vapour recovery and pressure distillate stabilizer, which recovers 90% of all the available butanes in the gases, leaving a stabilized product containing not more than 1% of propane and lighter. The gases at 30 lb. pressure are compressed to 175 lb. and admitted to the shell of a vertical absorber cooler at 175° F. Into the shell is pumped water-cooled raw pressure distillate which causes condensation of the hydrocarbons in the gaseous state. The mixture is then admitted to a weathering tank at 85–90° F. from which the fixed gases, containing 4–6% of the available butanes, are vented through a back-pressure valve. The liquid in the vent tank is pumped through a series of heat exchangers which raise the temperature to 175–185° F. by means of the hot product from the column. The charge is admitted into the column at such a point that its vapour pressure and that of the liquid on the tray of admittance are the same. The pressure of the column is held at approximately 250 lb., and the temperature of the bottom of the column at 350–375° F., usually by the medium of hot tar through a reboiler. The vapours leave the top of the column at 130–150° F., and are admitted to the reflux condensers and cooled to 100–110° F., where a further 4–6% of the available butanes is lost. The finished product is forced, after heat exchange, to a water cooler through a reducing valve and thence to storage.

The advantages of a plant of this type over the older double processing type are emphasized and attention is directed to the points to be considered in selection of the plant, viz: (1) pressure available in the pressure distillate accumulator, (2) temperature of distillate. The difficulties likely to be experienced are discussed and remedies suggested.

1343. Selective Light Distillate Refining and Recovery of By-Products. S. E. Campbell. *Refiner*, 1935, **14**, 381–383.—Describes a continuous process for refining light distillates, consisting of a series of contact towers, packed with finely-divided inert contacting material, such as No. 16 silica, and filled with the necessary reagents, to a depth of about one-quarter of the tower. For the treatment of straight-run California gasoline the reagents may be 15% soda carbonate, 10–20% caustic, 50% sulphuric acid and decolorising clay, each utilizing two towers. The light distillate passes successively through the solutions in the order given, and reagent free gasoline passes forward from the top of each tower to the next in the system. Such a continuous treating operation has been in constant commercial use for more than five years, treating in this manner between three and four million barrels of gasoline. B. C. A.

1344. Refining with Chlorex. I. R. Roseanu. *Mon. Petr. Roum.*, 1935, **36**, 1259–1262.—Describes the use of chlorex as an extracting agent for the production of high-grade lubricating oils. Results of plant operations are given. W. E. J. B.

1345. Breaking Emulsions. B. M. Erlikh. *Neft*, 1933, **4** (8), 22.—Emulsified crude oil delivered from the oil-fields to the Grozny refinery and stored in ponds was heated in

tube stills at 125° C. and 3 atm. passed to mud separators, mixed with good crude oil and distilled, giving satisfactory yields of distillate. In a laboratory investigation carried out with emulsified crude oil, emulsions were broken up by treatment with alkali sludge from kerosine and from the preliminary alkali treatment of lubricating oil grade crude oil. The ceresin emulsions, derived from the Grozny–Tuapse pipe-line, were easily decomposed by heating with steam in the presence of 5% NaCl effecting a saving of time amounting to 95%, as compared with the old method. Waste waters from soap manufacture had a similar action. For. Petr. Techn.

1346. Activated Earths. M. Krajcinovic and E. Cerkovnikow. *Chem. Ztg.*, 1935, 716.—Various bleaching earths have been examined with regard to their ease of activation. Drying under vacuum is to be preferred, as the residual water is favourable towards bleaching effect. Natural bleaching earths containing greater amounts of combined water are well adapted for activation. Heating to 350° C. may increase bleaching effect, the activation being intensified by preheating to 535–550° C. prior to treatment with HCl. L. S.

1347. Treatment of Liquid-Phase Cracked Gasoline. A. F. Dudenko. *Azerb. Neft. Khoz.*, 1934, **6**, 96–101.—Among all the refining methods tried with the liquid-phase cracked gasoline (acid, zinc chloride, gumbrin, and acid plus doctor) best results were obtained with gumbrin, the gasoline receiving a vapour-phase treatment. Thus, after 2½ months' storage the zinc chloride and the gumbrin-treated gasoline did not show any precipitate. The oxidation test carried out by the Ramsay bomb method showed that the former gasoline was very unstable towards oxidation, although its colour was very stable. For. Petr. Techn.

1348. Recovery of Toluene from Rumanian Petroleum. C. Leu. *Mon. Petr. Roum.*, 1935, **36**, 1311–1314.—Previous work on the above question in relation to spirits derived from Moreni, Boldeshti, and Arbanashi crudes is reviewed. For a practical solution of the problem it is suggested that care be given to the choice of suitable crudes such that the octane number of the residual gasoline will not be unduly affected when the appropriate cut is taken out, by fractional distillation. This cut might be solvent extracted, and the whole process dovetailed into the normal refinery procedure. W. E. J. B.

1349. Benzole Refining. Anon. *Chem. Trade J.*, 30.8.35, **97**, 178.—A semi-technical scale benzole refining unit handling 154 gal. per day has been erected at a Dunkirk gas works. The reagent used is naphthalene sulphonic acid (covered by Fr. P. 382,335–382,337) in solution in methyl alcohol (5 lb. acid/gal.). Benzole is refluxed for at least 3 hours at 85° C. with the reagent in a 28-gal. steam-heated lead-lined reaction tank from which the refined product flows continuously in a 20-gal. still. The still vapours (alcohol and benzole) are passed to an NaOH scrubber, condensed, separated from water and passed to storage. The process reduces the actual and potential gum to 10 mgm./100 ml. benzole, the refining loss being 9% of the crude benzole. The 154-gal./day plant is stated to cost (including plant for manufacture of the reagent) £160. The enhanced selling price of the specified motor benzole leaves a slight margin over the refining cost. Details of the method of preparation of the reagent are given.
C. L. G.

1350. Refining Industry Resorting to Three Methods for Making Lubricants. L. A. Calkins. *Oil & Gas J.*, 4.7.35, **34** (7), 43.—The three methods are: (1) distillation, removal of wax and subsequent refining by acid, earth and solvents, (2) synthetic, (3) adding materials designed to impart specific properties. All three methods may be combined to produce finished lubricants. Special consideration is given to the third method. Additives may be considered from the point of view of the purpose designed to serve, viz., (1) filler, (2) diluent, (3) other pour-point depressants, (4) oiliness carriers, (5) strictly extreme pressure materials, (6) anti-oxidants, (7) V.I. improvers, (8) prevention of adhesion of foreign material to the surface lubricated.

(1) The use of fillers as thickening agents to reduce noise is no longer necessary. The value of fillers such as graphitic materials, lead, zinc and other metal colloids or compounds is problematical. (2) Improvements in design and in fuels have rendered the addition of diluents to new oil unnecessary by reducing dilution during use, thus permitting satisfactory use of thinner oils. (3) The use of pour-point depressants which inhibit wax crystallization is increasing, particularly in Pennsylvania. They make possible satisfactory pumpability at low temperatures without the degradation

of product incident to dewaxing to give comparable pour point. (4) There is considerable diversity of opinion in regard to the value of oiliness carriers. Some are unstable in service, and by developing organic acidity are injurious to some of the newer bearing metals. Avoidance of over-refining helps to conserve the natural oiliness of lubricants. (5) The addition of extreme pressure materials such as lead soap, sulphurized and/or chlorinated materials, cresyl or triphenyl phosphate to motor oils has been adopted by some companies. The oils are sold on the basis of high load-carrying capacity. (6) According to Mougey, anti-oxidants are widely applied in the treatment of motor fuels, but are not making much headway in the field of lubricants. (7) Early service experience with viscosity index improvers such as exanol and uniflow indicated lack of stability. (8) This application has not been applied commercially, but research is being carried out.

Improvement in service characteristics due to adoption of any additive or any change in manufacturing process should be the final criterion, and not improvement in specification as judged by conventional laboratory tests. R. A. E.

1351. Manufacture, Packaging and Shipping of Oxidized Asphalts. (Art. 6.) C. J. Holland. *Petr. Eng.*, July 1935, **6** (11), 36.—A discussion is presented of fifteen fundamental principles (listed) involved in the design and operation of an oxidized asphalt plant. The use of light-charging stocks is desirable in order to give good ductility and cheaper manufacturing cost, but is limited by (*a*) necessity of obtaining maximum economic yield of lubricating oil distillate from the crude oil, (*b*) avoidance of abnormal losses through mechanical entrainment, (*c*) correct specification of products.

Removal of lubricating oil distillate is more profitable in the case of Texas Coastal, some Rumanian and Russian crudes, and definitely essential with waxy crude, when low wax specification asphalts are required. With Panuco crude minimum removal of the lubricating oil distillate is effected. The more convenient and cheaper continuous operation (85–90% operating time efficiency) as compared with batch operation (55%) is insufficiently realized. The maximum capacity limit for high-melting asphalt units is agreed by experts to be 5 tons per hour per unit, in order to provide a sufficiently low limit for abnormal operating conditions. The seasonal demand for asphalt also favours the use of small units. Vertical stills are preferred to horizontal owing to more uniform and intimate contact of liquid with air, and less tendency to puking. The diameter/height ratio should be small, in order to suit the production of high-melting-point asphalt, in spite of the lower rate of absorption of oxygen into the liquid. This is illustrated by a consideration of the dimensions and capacities of condensing stills of various diameter/height ratios. A large number of stills per battery is preferred to a few of large individual capacity. C. L. G.

1352. Oxidized Bitumen. J. Manheimer. *Petr. Zeit.*, 9.10.35, **31** (40), 4–9.—Various means for the oxidation of bitumen are discussed, including oxidation in tanks, discontinuous oxidation in batch stills, continuous oxidation in shell stills and oxidation in towers. The essential factors influencing the process are described—namely, temperature, air, quality of the initial material, surface undergoing oxidation, deposition of carbon and the height of the liquid column. The effects of these are described in the following :—

Generally, temperature differences exert an extensive influence on the oxidation time, and sometimes on the quality and quantity of the bitumen.

Regarding the effect of air, the higher the oxidation temperature the greater is the absorption of atmospheric oxygen. At constant temperature and with increasing air, the oxidation effect decreases, with a constant quantity of air and with increasing temperature the effect increases, and with increasing temperature and increasing air the effect increases rapidly. It is also found that the higher the softening point of the final product the less is the absorption of air. The best absorption effect of oxygen in the three systems is experienced in tanks with 55–65% absorption; the oxidation amounts to 45–55% in the continuous oxidation system, 35–45% in the batch still and 70–90% in the towers.

The properties of the initial material, *e.g.* softening point, chemical composition, influence the oxidation and the properties of the bitumen to a great extent. Hard asphalt, since it only becomes enriched at the expense of other groups, requires no oxidation. Soft asphalt requires only a very small quantity of air, since it is con-

verted easily into hard asphalt, whilst resins and oily constituents are not easily converted into other groups, and require a large quantity of air. This fact explains why initial products of varied origin or of different softening points exert different effects under similar conditions of oxidation. The oxidation is also rendered more effective the greater the surface.

As regards the deposition of carbon, the higher the oxidation temperature and the higher the softening point of the final product, the greater is the separation of carbon. This depends partly on the chemical composition of the initial product and partly on the temperature of the air-blast. Gases and gas oil are obtained as by-products. In conclusion, it is claimed that bitumen produced by oxidation is equal in quality to that produced by distillation. W. S. E. C.

1353. Asphalt from West Texas Crude. G. Weber. *Oil & Gas J.*, 20.6.35, **34** (5), 18.—A 2000-brl.-capacity asphalt plant has been placed in operation at a Big Spring Texas refinery, running on 29 A.P.I. crude from Howard, Glasscock and Ector counties. The crude is heated in a gas-fired pipe still and charged to a large column, where gasoline, naphtha, distillate, and two gas oil cuts are taken off, leaving a 20% residue of 13–14 gravity. This is run to a light heater and flashed in a vacuum tower at 27–29 in. Hg vacuum, where 25% is taken off as heavy gas oil. The residual asphalt is partly marketed as such, after suitable blending, and partly blown in obsolete Jenkins still tubes, suitably adapted. The negative Oliensis spot test on the blown bitumens indicates the absence of burning or cracking, due to the velocity of the stock through the still tubes. Thirteen standard and 12 special specification grades are manufactured for roofing, paving, fibre-coating and roof-paints applications. After 6 months' satisfactory operation it has been decided to double the capacity of the plant. C. L. G.

1354. Rubber in Road Tars. D. D. Pratt and R. Handley. *Chem. Trade J.*, 23.8.35, **97**, 152.—The *Bulletin of the Rubber Growers Association* includes a report on work carried out at the Chemical Research Laboratory, Teddington, on the possibility of improvement of road tars by the addition of rubber. In Great Britain approximately 2,000,000 tons of tar are produced annually, of which 50% is used for road purposes.

The constitution of coke oven, horizontal and vertical retort, and low-temperature tars, is discussed, and the method of production of road tars of each type described.

Owing to the rapid precipitation of rubber from solutions in anthracene oil on the addition of pitch, a stabilizing medium was sought. Emulsions of rubber latex in tar oils were made in a Hurrel Homogenizer and clarified by heating to 120° C. for 20 hours, or by re-passing the emulsion 8–10 times through the mill at 100° C. for 10–15 mins. Low-temperature tar oils absorbed $\geq$ 7–8% of rubber oils and anthracene oils $\geq$ 5%. The final clear solution could, however, be re-used to make up emulsions containing 20% of rubber. Similar emulsions were made from vulcanized latex. Only up to 8% of pitch could be added to the anthracene oil–rubber mixture without precipitation, but no separation occurred when the corresponding pitch was added to the vertical retort or low-temperature tar oils–rubber emulsion. This difference was attributed partly to the presence in anthracene oil of complex solid hydrocarbons which exert a salting-out effect when pitch is added, and partly to the greater stabilizing effect of the paraffinoid oils in low-temperature tar as compared with that of the aromatic oils of high-temperature tars. However, special fractions of oils from horizontal retort tars yield stable rubber complexes containing up to 50% of pitch. It is suggested that low-temperature tar oils would be a suitable medium for stabilizing horizontal tar–rubber mixture. As, however, the addition of low-temperature tar affects the drying qualities of the tar, the addition of the selected fractions from horizontal retort tar may be preferable. With vulcanized latex stable emulsions were given with all types of tar oils and pitches.

A series of pitch and rubber complexes containing 10–90% rubber has been prepared by homogenizing 16% unvulcanized 60% latex with neutral low-temperature tar oil (b. p. 100–180° C.). The required quantity of pitch is heated to 80° C., re-homogenized, and the volatile oils removed by distillation. Further analyses and road tests will be carried out on the rubber–pitch mixes so obtained. C. L. G.

1355. Preparation of Ethyl Alcohol from Ethylene from Petroleum Gases. M. A. Dalin and Y. S. Gutuirya. *Azerb. Neft. Khoz.*, 1934, **2**, 90–93.—The construction of the mixer used for contacting H_2SO_4 with ethylene gas requires for an efficient

conversion a thorough contact of the atomized acid with the gas. This was attained by constructing a mixer equipped with paddles and rotating at 600–1000 r.p.m. This permitted the lowering of acid consumption (at 80° C.) to 3·2 kgm. per kgm. 100% ethyl alcohol obtained. The application of pressure (up to 15 atm.) lowered the acid consumption to 2·4 kgm. The preparation of *iso*propyl alcohol from the cracked gases was tried at 25° C. using a 90% acid, whereby other gas constituents were not attacked. Here the acid consumption amounted to 4–4·2 kgm. per kgm. *iso*propyl alcohol when working at atmospheric pressure. The experiments are described.

For. Petr. Techn.

1356. Action of Hydrogen on Carbon and Special Steels. D. Alekseev, P. Permyakov and V. Ostroumov. *For. Petr. Techn.*, 1934, **2** (12), 494.—A number of Russian steels were exposed to hydrogen pressures up to 600 atm. and temperatures to 450° C. during 300 hours. Carbon steel was least stable when exposed to high temperature and pressure. Alloyed steels containing nickel rapidly lost their mechanical properties. It is concluded that, beginning with a given temperature and pressure hydrogen diffuses with a measurable velocity, reacting with the cementite converting the pearlitic structure into an agglomeration of ferritic grain of a weak structure. The resulting decrease in volume makes cracks in the steel and facilitates further penetration of hydrogen, permitting the escape of methane from the steel which is the main cause of its brittleness. The experiments are described and photomicrographs are given.

G. R. N.

1357. Use of Ammonia in Corrosion Prevention. J. W. Smith. *Refiner*, 1935, **14**, 395.—In an equipment experiencing severe corrosion in the vapour lines, introduction of ammonia above the heat exchangers resulted in an excess of reagent as indicated by odour in the run-down tanks. The reagent was then introduced into the bubble tower above the flash point, with elimination of odour and without causing salting of the trays. *p*H tests on the overhead water of less than 7·0 is sometimes associated with slight corrosion as shown by potassium ferrocyanide test, whilst values in excess of 7·2 lead to corrosion of brass and Admiralty condenser tubes, and to the use of excess ammonia, so that a value between these limits is recommended. B. C. A.

1358. Preservation of Cracking Equipment. O. E. Andrus. *Oil & Gas J.*, 1.8.35, **34** (11), 34.—Measures which are being taken in order to reduce the hazards in the use of cracking equipment include (*a*) reduction of working pressure or temperature when inspection shows it to be necessary, (*b*) the use of thicker wall vessels, (*c*) introduction of arc-welded vessels, (*d*) use of ganister linings, (*e*) use of chromium plating (satisfactorily corrosion-resisting, but susceptible to mechanical injury and expensive to apply), (*f*) spraying with aluminium, (*g*) use of non-corrosive alloy buttons or plugs to indicate by contrast presence of corroded areas, (*h*) development of carbon steel with stainless alloy (high Cr or Cr–Ni) linings. Modern stainless alloys of the Cr–Ni type do not suffer from intergranular corrosion as in the case of the earlier alloys, and have given 100% protection to every portion of the load-carrying steel so protected, even over periods of 4 and 5 years.

C. L. G.

1359. Elaborate Test System Should Follow Fabrication of Pressure Vessels. T. C. Schuyler. *Oil & Gas J.*, 1.8.35, **34** (11), 40.—In order to ensure that fusion-welded cracking vessels are capable of withstanding severe service, manufacturers are adopting the X-ray or other radiographic means of testing the welds. The radiograph will record variations of 2% in the thickness of the weld, the technique being checked by comparison of the appearance of the weld with that of a metal gauge or "penetrameter," which is in effect an artificial defect of just over 2% of the weld thickness. From an examination of the radiographs, experienced operators can indicate any questionable areas in the weld, even up to 4½-in. thickness of weld.

Reference is also made to the method of stress relief of welded vessels by heating in a furnace.

C. L. G.

1360. Economics of Gasoline Volatility. H. W. Field and M. J. Fowle. *Oil & Gas J.*, 27.6.35, **34** (6), 38.—From 1925 to 1934 there was a distinct increase in volatility of gasolines marketed, particularly as regards warming-up performance (percentage to 212° F.) and accelerating ability (percentage to 284° F.). The increase was fairly general and uniform, but in 1935 very wide ranges in the percentages to 212° F. and 284° F. exist in fuels available to the consumer, resulting in lack of standardization in

accelerating and warming-up properties of gasolines. Comparison is made of the yields of straight-run and cracked gasolines of the light 1935 type and of the typical 1934 type from average crude. The volatilities of the typical 1934 and the light 1935 gasolines at 212° F. are taken as 36 and 50%, respectively, and at 284° F. as 68 and 83%, respectively. It is pointed out that the production of natural gasoline is limited in relation to crude production, and that there is insufficient available to permit a general change to light 1935 type gasoline solely by its utilization. From the yield data, comparative costs of the two types of gasoline as straight-run and cracked are calculated. The increased cost of the light straight-run is estimated at 23% and of the light cracked gasoline at 35%. In the case of a combined primary distillation and cracking plant, in which the cracking stock utilized is home produced, the increased cost of production of the light gasoline is calculated to be 29%. Therefore, whilst the temporary excesses of light natural gasolines permit the production of a limited quantity of volatile fuels at a low price, a general shift to highly volatile gasolines would soon consume these excesses and result in an increased cost of approximately 30%. R. A. E.

1361. Patents on Cracking. M. W. Colony. U.S.P. 2,012,959, 3.9.35. Vapour-phase cracking, using a non-condensable gas as the heating medium. The cracked vapours and gas are scrubbed, and the heat carrier gas is returned to the system, a portion being used to regulate the vaporization of the charge stock.

E. W. Isom. U.S.P. 2,013,803, 10.9.35. A process in which the stream of heated product is subjected to a succession of heat-exchanges with products of combustion hotter than the oil, then digested in a digestion zone without extraneous heating or cooling.

H. J. Schiffler. U.S.P. 2,014,189, 10.9.35. A steel for the construction of those portions of a cracking plant which come into contact with heated oil. The steel is free from Ni, but contains Cr 5–8%, Al 0·3–4%, Si 0·2–2%, Mo 0·3–2%, Be 0·1–2%, the balance being Fe.

J. D. Seguy. U.S.P. 2,014,212, 10.9.35. Continuous coking of oil by direct contact with hot combustion gases. The oil is introduced into the coking zone in a plurality of streams (at sub-atmospheric pressure) of progressively smaller cross-section. The gases are passed in the direction of decreasing cross-section of the streams.

E. E. Ayres. U.S.P. 2,014,350, 10.9.35. Liquid-phase cracking at 800–1050° F. and 1000–5000 lb. per sq. in. in the presence of hydrogen (0·5–10% by wt. of oil) but in the absence of a catalyst. The conditions of the reaction are such that no coke is formed and substantially no hydrogen is consumed.

C. A. Hillman. U.S.P. 2,015,110, 24.9.35. A process in which it is possible to maintain a high coil inlet temperature when charging a low-boiling feed stock. Means are also provided for utilizing the heat of the condensed oil to vaporize the lighter fractions of the feed stock.

A. T. Chove. U.S.P. 2,015,420, 24.9.35. An improvement in the Gyro process in which all refractory cycle stock is eliminated from the viscosity-breaking and vapour-phase cracking operations. This enables higher pressures to be employed at the inlet of the cracking zone.

W. Lelgemann. U.S.P. 2,015,529, 24.9.35. Cracking stock is mixed with powdered aluminium (3 oz./brl.) heated in a still to 800° F. and nitrosyl chloride (1 lb./100 gal.) added. W. H. T.

Aktis. D.R.P. 595,330, 12.6.31. High-boiling tars and oils are cracked by high-frequency fields of 500 m. wave-length at 200–500° C. and 2–20 atm. In preparing the high-frequency coils, alloys of at least two of the following metals are used: Ag, Co, Cu, Fe, Mo, Ni, Pb, Ta, W.

Brikett u. Braunkolenind. D.R.P. 618,224, 17.5.31. Hydrocarbons are converted in externally heated, vertical, continuous retorts, which are filled with coke or coal. The speed of the oil vapours is kept at not less than 150 times that of the coke. L. S.

1362. Patents on Hydrogenation. R. Holroyd and C. Cockram (I.C.I.). E.P. 433,020, 6.8.35. Hydrogenation in which the reaction products contain corrosive halogen. The products are cooled in a protected vessel to between 200° and 350° C. in the presence of ammonia.

R. Holroyd and C. Cockram (I.C.I.). E.P. 432,958, 6.8.35. Similar to E.P. 433,020,

halogen compounds being eliminated from the reaction gases by contact with alkali before the temperature of the reaction gases falls below 350° C.

Int. Hydn. Pats. E.P. 433,593, 16.8.35. Mild catalytic hydrogenation of oils, so controlled that only the highly unsaturated constituents are hydrogenated. A suitable catalyst is nickel molybdate previously treated with H_2S at high temperature.

I.G. Farbenind. A.-G. E.P. 434,141, 27.8.35. Destructive hydrogenation of carbonaceous materials at 300–700° C. and above atm. pressure. The catalyst comprises metal sulphides prepared by the conversion of sulpho-salts with compounds of metals (not alkali or alkali-earth metals), preferably with compounds of heavy metals dispersed in liquid.

Int. Hydn. Pats. Co. E.P. 434,307, 29.8.35. Hydrogenation of coal (carbon content less than 75%) in the form of a paste with oil, the mixture being given a heat-pretreatment at 260–410° C. for less than 200 seconds prior to hydrogenation.

Int. Hydn. Pats. Co. E.P. 434,624, 5.9.35. Hydrogenation apparatus in which those parts of the plant which come into contact with sulphurous compounds are given a protecting coating. The latter is applied by treatment at 600° C. with zinc vapour, oxygen being excluded, and a reducing gas being passed slowly through the zinc treatment vessel. W. H. T.

1363. Patents on Refinery Plant. Ateliers Neyret-Beylier v. Piccard-Pictet. E.P. 433,103, 8.8.35. A pivoted valve for automatically regulating the flow of liquids, to give a constant rate of flow irrespective of pressure.

Electrical Improvements, Ltd. E.P. 433,123, 9.8.35. A liquid level-indicating device operated by an optical system.

Akt. Separator Nobel. E.P. 433,587, 16.8.35. Continuous-treatment apparatus, in which pipes, tanks, etc., are vented to permit the escape of gas at suitable points.

J. Dusek. E.P. 434,393, 30.8.35. Apparatus for the continuous preparation of carbon black.

N. Caro and A. R. Frank. D.R.P. 565,039, 7.1.28. Device for introducing gases or vapours into liquids before or after treatment with reaction masses.

Industriekemiska Aktiebolaget. D.R.P. 615,845, 18.5.29. Means for evaporating indirectly-heated fluids with the aid of a stream of gas. L. S.

Thermal Ind. and Chem. Research Co. E.P. 434,541, 4.9.35. Fractionating apparatus consisting of a column fitted with an external separator and a dephlegmator which is provided with an outlet from which both condensate and vapour flow to the separator.

I.C.I. E.P. 434,590, 5.9.35. A vertical-flow gas scrubber, with packing of the grid or lattice type, fitted with deep plates arranged vertically side by side at the gas-inlet end of the packing in the path of the scrubbing liquor. The plates are spaced at a greater distance apart than the elements making up the main body of packing, their tops being enlarged so as to adapt them to receive a greater proportion of scrubbing liquor per unit area than the main packing.

I.C.I. E.P. 434,726, 9.7.35. High vacuum distillation apparatus comprising a plurality of distillation units housed in a common vacuum chamber. Each unit comprises distilling and condensing surfaces of independently adjustable temperatures, in close proximity to each other. The system is continuous, and means are provided for counter-current transference of distillates from one unit to another.

H. A. Brassert & Co. E.P. 434,948, 9.9.35. A furnace construction having a floor or heating wall separating the reaction chamber from the heating flues. Heat is transmitted directly through the floor or heating wall, which is formed of a series of blocks adapted for relative movement, so that, under expansion, the floor or wall may flex.

I.C.I. E.P. 435,032, 9.9.35. Apparatus for the vacuum distillation of materials, which yield solidified distillates and/or residues, in which relative movement of the condensing surface and a scraping surface is brought about. The non-flowing distillate is thus prevented from fouling the distilling surface which is in close proximity to the condensing surface.

J. K. Roberts. U.S.P. 2,013,992, 10.9.35. Apparatus for stabilizing low-boiling hydrocarbons.

A. E. Harnsberger. U.S.P. 2,014,564, 17.9.35. A furnace in which the tubes which are subjected to high temperature are constructed of heat and oxidation resistant alloy.

M. Luther. U.S.P. 2,015,347, 24.9.35. Apparatus for treating liquids with gases or vapours. It comprises a series of vessels fitted with filtration medium. Gas is admitted at the bottom of each vessel and removed from the top, and then passed to the bottom of the next vessel in the series. W. H. T.

1364. Patents on Crude Oil. W. B. Hendrey and I. A. Ebaugh. U.S.P. 2,014,936, 17.9.35. Petroleum emulsions (water in oil) are resolved by maintaining the emulsion at a temperature of 180–200° F. in the presence of a small quantity of aqueous alkali solution and still bottoms from the vacuum distillation of lubricating oils.

M. De Groote. U.S.P. 2,015,260, 24.9.35. A process is described for breaking petroleum emulsions of the water-in-oil type consisting of subjecting the fluids in a well prior to emerging from the well head, to the action of a demulsifying agent, *e.g.* $CaCO_3$, $MgCO_3$, or $BaSO_4$, etc., together with a monopropylated, naphthalene sulphonic acid sodium salt. W. S. E. C.

1365. Patents on Gas. G. Nonhebel, J. L. Pearson and I.C.I., Ltd. E.P. 433,039, 29.6.35. Inlet purification of gases to prevent deposition of scale caused by lime used in the system. The liquor is treated after scrubbing to remove the whole of the supersaturation of the liquor due to calcium sulphite and sulphate before recirculating over the scrubbing surfaces. The return of the liquor is delayed for a definite calculated time which is sufficient to enable desupersaturation of the liquor by crystallization. W. S. E. C.

Gastechnik Ges. E.P. 433,823, 21.8.35. Sulphur compounds (H_2S) are removed from gas by passage of the latter through a succession of layers of porous sulphur absorbing mass. The absorbed sulphur is set free by oxidation, the mass being regenerated by treatment with air.

Machin. App. Fabrik. E.P. 434,673, 6.9.35. Removal of CS_2 from gases by conversion into H_2S, which is then washed out of the gas. Conversion is effected by passage at 500–600° C. over copper sulphide.

Metal. Ges. A.-G. E.P. 435,116, 16.9.35. Recovery of SO_2 from gases by treatment with a mixture of organic bases (*e.g.* aromatic amines) and water, followed by heating. W. H. T.

Mapag. D.R.P. 612,537, 7.11.33. Two-stage rectification of liquefied gas mixtures.

C. Fleck. D.R.P. 616,068, 1.7.31. A centrifugal separator for removing solids and fluids from gases and vapours. L. S.

1366. Patents on Motor Spirit. Soc. Anon. Carburanti Italia. E.P. 433,410, 14.8.35. Production of high anti-knock fuels from one or more alcohols and one or more aliphatic or aromatic hydrocarbons (alcohols 20–75%). Both components are sprayed into a reaction vessel at a temperature in excess of the b. p. of the least volatile component by about 150° C., at atmospheric pressure.

M. J. Welsh. U.S.P. 2,013,083, 3.9.35. Sweetening cracked gasoline obtained from naphthenic stock, by treatment with an adsorbent, washing with water and then contacting with an alkaline sweetening agent. The water wash prevents discoloration during the last stage of treatment.

W. L. Benedict and C. Worth. U.S.P. 2,013,399, 3.9.35. Cracked gasoline is refined by treatment with sulphuric acid containing dissolved ferric chloride.

W. L. Benedict and C. Worth. U.S.P. 2,013,400, 3.9.35. Refining cracked gasoline by means of hydrochloric acid containing dissolved ferric sulphate.

W. M. Malisoff. U.S.P. 2,013,663, 10.9.35. Sulphur removal by the selective solution effect of an ether of a polyhydric alcohol.

C. F. Teichmann. U.S.P. 2,014,915, 17.9.35. Cracked distillate is heated with a partly spent catalyst at 400–700° F. and 1000–2000 lb./sq. in., thereby polymerizing the undesirable unsaturated components. The treated material is vaporized, the vapours are fractionated and then contacted with a suspension of catalyst in liquid hydrocarbon. The vapours are condensed, high-boiling oil is separated from the catalyst, and the latter passed to the first stage of the process.

E. F. Pevere. U.S.P. 2,015,038, 17.9.35. A sweetening process in which the mercaptans present in hydrocarbon oil are converted to the corresponding disulphides by the action of an aqueous alkaline solution of a phenol.

W. M. Malisoff. U.S.P. 2,015,080, 24.9.35. Desulphurizing by contacting with aluminium sulphide at above 300° C. in the absence of hydrogen introduced from an extraneous source. W. H. T.

1367. Patents on Kerosine. Anglo-Iranian Oil Co., F. B. Thole and S. F. Birch. E.P. 433,197, 6.8.35. Refining of petroleum distillates in which sulphur dioxide, liquid hydrogen chloride or liquid ammonia is used for selective solution or extraction of the aromatics, unsaturated hydrocarbons and other substances. The improvement consists in cooling the extract to a temperature 20–40° F. below that of extraction to effect separation or solution according to specific gravity. The lower layer contains a solution in sulphur dioxide of hydrocarbons richer in aromatics than the extract normally obtained. W. S. E. C.

1368. Patents on Lubricating Oil. Standard Oil Co. E.P. 433,257, 12.8.35. Production of improved lubricating oils and greases by adding anti-sludge forming properties, *e.g.* ditolyl mercury, triphenyl bismuthine, trinaphthyl-α-propyl bismuthine, dicresyl cadmium, cresyl phenyl zinc, naphthyl mercuroiodide or triphenyl stibine.

J. Y. Johnson. E.P. 433,061, 8.8.35. Production of lubricating oils by subjecting normally liquid hydrocarbons poor in hydrogen to the action of silent electric discharges and hydrogenating the resulting products still poor in hydrogen at 150–300° C. and at 20–500 atm. pressure in the presence of catalysts. W. S. E. C.

G. R. Pierce and L. B. Denning. E.P. 433,876, 22.8.35. A process for reclaiming used lubricating oil. The heated oil leaving the filtration zone is contacted with a cool metal surface in order to remove matter which will deposit on the metal surface.

Standard Oil Dev. Co. E.P. 434,056, 26.8.35. An extreme pressure lubricant comprising a hydrocarbon base oil, a soluble lead compound and corrosive sulphur (ratio of Pb to S, 6 : 1).

C. & S. Clementson. E.P. 434,240, 28.8.35. Corrosion in engine cylinders is prevented by adding to the lubricating oil a mixture of an alkali peroxide and an alcohol, together with a homogenizing agent.

I.G. Farbenind. A.-G. E.P. 434,295, 29.8.35. Lubricating oil is improved by adding an oil-soluble vacuum residue solid at normal temperatures and derived from de-asphalted hydrocarbon products containing cyclic constituents.

Sharples Spec. Co. E.P. 434,579, 4.9.35. Multi-stage dewaxing, the partly dewaxed stock being heated between each stage, in order to effect solution of residual wax and to facilitate the ensuing dewaxing operation.

Stand. Oil Dev. Co. E.P. 434,626, 5.9.35. Lubricating and insulating oils are improved by the addition of a high-boiling aryl ester of an inorganic acid and a soluble oxidation inhibitor.

Stand. Oil Dev. Co. E.P. 434,672, 6.9.35. Solvent extraction of heavy oil by treatment with light hydrocarbon mixtures in the liquid phase at within 80° F. of the critical temperature of the solvent.

Stand. Oil Dev. Co. E.P. 434,714, 6.9.35. Solvent extraction with light hydrocarbon solvents, the heavy fraction so obtained being re-extracted at a lower temperature. W. H. T.

D. F. Edwards and J. V. Starr. U.S.P. 2,013,040, 3.9.35. Solvent extraction of petroleum distillates using phenol in which the oil is treated with a substantially anhydrous mixture of phenol and a sufficient quantity of a cyclic alcohol to render the solvent fluid.

J. W. Chewning and W. C. Dickerman. U.S.P. 2,014,556, 17.9.35. Method of utilizing acid sludge obtained from the refining of petroleum oils by mixing it with a heavy oil and contacting the mixture with hot, dry, inert gas which is incondensable at normal temperatures and pressures. The sulphur compounds are decomposed, the light ends distilled off and the resulting vapours cooled to liquefy the sulphur dioxide.

J. M. Musselman. U.S.P. 2,014,629, 17.9.35. Dewaxing of lubricating oils by treating them with 3–10% of anhydrous aluminium chloride at 400° F. for ¼–4 hrs. The mixture is then chilled and filtered.

C. F. Teichmann. U.S.P. 2,015,046, 17.9.35. Solvent extraction of lubricating oils using a solvent liquid containing benzole and carvacrol. W. S. E. C.

Aktiebolaget Separator. D.R.P. 605,597, 13.4.33. The use of centrifuges is proposed for the separation of acid sludge.

F. C. Gebhardt. D.R.P. 613,362, 5.10.32. Mineral oils of at least 2·05° E. at 37·8° C. are mixed with aluminium salts of fatty acids containing at least 15 C atoms in the molecule at 125° C. The mixture is then cooled so that the fatty bases remain uniformly dispersed in a gritty and sticky form. L. S.

1369. Patents on Fuel Oil. L. N. Reddie. E.P. 433,239, 12.8.35. Production of smokeless fuel briquettes from lignites, peats, cracked residues, tar, etc. These are distilled to 600° C. and reduced to particle size, which is usual for briquetting. They are then mixed with 20–30% of finely-powdered coal or silica or lime and briquetted by relatively light pressure, and again distilled to 600° C. W. S. E. C.

A. A. Roberts. E.P. 433,348, 14.8.35. Coal-oil mixtures are improved by the addition of a water and oil insoluble combustion controlling agent (*e.g.* 1% of borosilicate), the mixture being stabilized by means of starch or casein.

A. A. Roberts. E.P. 434,109, 27.8.35. Fuel oils are improved by emulsifying a minor proportion of water therein by means of casein or a carbohydrate colloid such as starch.

A. Roberts and C. W. Smith. E.P. 434,180, 27.8.35. A boron compound (insoluble in water or oil) is added to fuel oil or coal-oil mixtures in order to control the combustion or to increase the effective temperature of combustion. W. H. T.

Ges. fur Teerverwertung. D.R.P. 617,147, 2.9.30. Mixtures of coal, tar and/or oil with aliphatic hydrocarbons are heated in the presence of ferric oxide. L. S.

1370. Patents on Asphalt. Thermal Industrial and Chemical Co. E.P. 432,998, 7.8.35. Crude tar is distilled down to a hard pitch residue, to yield an oil boiling above 325° C. The oil is treated with acid or alkali, the mixture separated into two layers and gums are separated from the layer in which they are concentrated. The gums are mixed with the pitch residue and the mixture is cut back with selected condensates from the primary distillation.

A. Wacker Ges. E.P. 433,826, 21.8.35. The fluidity of coal-tar pitch is increased by the addition of a liquid paraffin hydrocarbon and a small proportion of an oxygen containing organic solvent of the aliphatic and hydroaromatic series. W. H. T.

H. F. Angstadt. U.S.P. 2,013,619, 3.9.35. Production of asphalt from petroleum residues containing soaps formed by distillation in the presence of an alkali. W. S. E. C.

1371. Patents on Special Products. British Thomson-Houston Co., Ltd. E.P. 433,072, 8.8.35. Insulating materials are prepared by heating a mixture of a phenyl substitution product of a halogenated methane compound and benzene or a chlorbenzene, in the presence of aluminium chloride. A non-crystalline halogenated condensate product is isolated from the products of the reaction, comprising di- or tri-phenyl methane.

W. W. Triggs. E.P. 433,559, 16.8.35. Production of formaldehyde from methane and oxygen. The latter, together with less than 1% of nitrogen oxides (gaseous oxidation catalyst), are passed at 600–700° C. over a catalyst, which consists of one of the oxides or carbonates of Al, Cr, V, Mo, Wo, Mn, Ni, Co, and one of the oxides or carbonates of Be, Mg, Ca, Sr, Cd, Ba, Hg, Ti, Ge, Zr, Sn, Ce and Pb.

I.C.I. E.P. 433,312, 13.8.35. Alkyl (C_{16}–C_{18}) sulphonic acids are formed by reacting alkyl (C_{16}–C_{18}) inorganic esters in a closed vessel at 120–150° C., with aqueous solutions of sulphites in the presence of aniline or other aromatic base and a phosphate.

Bat. Petm. Mij. E.P. 434,011, 23.8.35. Manufacture of ethylene oxide by catalytic oxidation of ethylene with oxygen. The catalysts are obtained by decomposing organic silver compounds (*e.g.* oxalate) by heating and may be activated by the presence of copper, gold, iron or manganese.

Standard Oil Dev. Co. E.P. 434,311, 29.8.35. Oxidation products of hydrocarbon-wax are prepared by reducing the oil content of a petrolatum to 25% or less and subjecting the wax to oxidation.

I.C.I. E.P. 435,039, 12.9.35. Manufacture of cleaning and emulsifying agents by conversion into their sulphuric esters, of the aliphatic hydroxy-sulphides obtained by interacting alkyl (C_{16}–C_{20}) mercaptans with halohydrins. The conversion is brought about by reacting the hydroxy-sulphide with an addition product of SO_3 and a tertiary amine. W. H. T.

K. Linder and J. Zickermann. D.R.P. 614,227, 30.1.27. Wetting agents are produced by sulphonating high-boiling hydrocarbons combined with aliphatic alcohols or carbonic acids (containing 10 C atoms max.), hydroaromatic alcohols or ketones or phenols at 35° C. with the aid of 100–200% of sulphuric acid halogen hydrides. L. S.

1372. Patents on Coal. H. A. Brassert & Co. E.P. 434,737, 9.9.35. A process for coking coal in admixture with liquid hydrocarbons, in which a bed of solid fuel is

subjected to coking conditions by applying heat from below the charge. Liquid hydrocarbons are added to the top of the charge during the coking operation.

W. H. T.

Class 700. Utilization.

1373. Continuous Regeneration of Benzole Wash Oil. A. Thau. *Gas W.*, 1935, **103** (No. 2661), Coking Section 84–86.—The process discussed in the paper was introduced by Weindal, and consists of a vacuum distillation of the spent wash oil, the still being heated by gas. Gas under pressure is introduced into the still to agitate the boiling oil and enable the distillation to be carried out at a reduced temperature. This gas is finally withdrawn into the suction gas main of the plant before the coolers, vacuum being maintained by careful adjustment of the gas entering the still. A diagrammatic sketch of the plant is given, together with a description of the details. It is claimed that wash oil of even viscosity and quality is maintained in the circuit of the benzole plant, and that a benzole yield equal to that when fresh oil has been introduced into the circuit is obtained. W. A. W.

1374. Oil Firing for Hop Kilns. J. Rogers. *Fuel Economist*, 1935, **10**, 968–970.—In the old (direct) method of hop-drying, fires made from solid fuels were placed at the base of the kiln, and the hot gases issuing, together with induced air, were drawn through the hops. This involved handling the hops to ensure adequate drying, fluctuation of temperature due to varying conditions of the fire and possible contamination with arsenic or fire ash from the solid fuel used. An alternative (indirect) method was by means of air at 150° F. from a separate air heater, forced through the hops by means of a fan. By this means the risk of contamination was avoided, but fluctuations in temperature could still occur unless adequate stoking was provided. The use of oil overcomes these difficulties, because an oil burner can be easily adjusted to give the desired heat and then left unattended for long periods. Oil can be used equally well with the direct or indirect method of drying without any risks of contamination from the products of combustion, and, as fuel oil contains less than 1 millionth part of arsenic, no contamination from this source need be expected. A description of suitable burners is given, and it is found that 5 gallons of oil are required to dry 1 cwt. of hops. W. A. W.

1375. Aircraft Spark Ignition versus Compression Ignition Engines. K. A. Browne. *J.S.A.E.*, 1934, **37**, 342–348.—The author gives data on the fuel economy of present-day American air-lines and points out the importance of improving fuel consumption to increase pay load. Graphs are given which show the theoretical efficiencies obtainable with the Otto and Diesel cycles with corrections to the formula for Air Standard efficiency as presented by Goodenough and Baker. After giving data on service engines, predictions are made as to the probable fuel economy which will be obtained in the near future with gasoline engines, and the reasons why service figures fall short of test-bench results are discussed. As regards the compression ignition engine, it is pointed out that unless flights of over 5 hours' duration are made, it is at present difficult to justify the use of the diesel engine. The author is of the opinion that the C.I. engine will not come into general use for aircraft until the weight is reduced to practically that of the gasoline engine. The most promising type for development in the author's opinion is the two-stroke. Some details are given of the Jumo and Dechamps two-stroke engines, and the article concludes with a specification for C.I. engines which the author considers can reasonably be aimed at at the present time. C. H. S.

1376. High-Speed C.I. Engine Performance. Three Types of Combustion Chamber. E. G. Whitney. *J.S.A.E.*, 1935, **37**, 328–341.—The article deals with a series of experiments carried out at the Langley field laboratory of the N.A.C.A. to determine the relative merits of three different types of combustion chamber on a special 5 × 7 single-cylinder diesel test engine. The types of combustion chamber used were, first a pre-chamber, secondly a quiescent combustion chamber, and thirdly a displaced piston type. With the first type the effects of varying connecting passage size, shape of chamber, location of fuel spray and boosting are discussed.

With the quiescent combustion chamber the problem is chiefly the design of a

satisfactory multi-orifice nozzle, and a table is given which summarizes the results of a very large number of experiments in this direction.

The best results were obtained with the displaced piston type of combustion chamber. In this type a lug is located on the piston top which enters the throat of the chamber about 40° before T.D.C. Mechanical clearances between the lug and throat control the airflow into the chamber just prior to the fuel injection.

Results obtained with this type, with variations of passage between lug and throat, are given, and the effect of single and double passages and boosting is dealt with. The authors conclude that the displaced piston is the best type so far developed, and consider that this type can be made to compare very favourably with current gasoline engines, and from an analysis of the results obtained it is shown that a further increase in performance of 27% can be looked forward to with confidence. C. H. S.

1377. Russian Diesels. N. R. Brilling. *Aut. Eng.*, 1935, **25**, 333–336.—A review of the position as regards high-speed oil engines in Russia. A tabulated specification of the principal makes is given, together with sectional drawings and descriptions. C. H. S.

1378. Cut-back Asphalt and Road Oils Used in Modern Highway Construction. H. G. Nevitt. *Oil & Gas J.*, 1.8.35, **23** (11), 36 and 8.8.35, **34** (12), 38.—A comparison is given of cut-back asphalts and road oils, with discussion of their relative merits, based on a brief survey of their fundamental characteristics followed by a logical analysis of (*a*) the functions required of the liquid asphalt or its residue in its final form, (*b*) the behaviour of the liquid asphalt in relation to its surroundings, (*c*) the requirements of material to give the desired results. Under these headings the characters of (1) the mat, (2) the primer, and (3) the seal coat are discussed.

1. *Mat.* (*a*) The function of the bituminous material when the mat is in its final form is to cement the aggregate particles together against indirect stresses in the case of a flexible surfacing and, in addition, against the beam action or slab effect as a result of the tensile strength of the cement in the case of a semi-flexible surface. The resistance to tensile strength may be developed as a thin film resistance at the points of contact of the aggregate particles, or owing to the consistency of the binder in the range of ductile flow. In addition, the residue must stay relatively "live," and must resist water action and be physically and chemically stable.

(*b*) In mechanically mixed mats there is an upper limit of consistency of the liquid asphalt necessary to prevent rough surface, balling, etc. In the penetration type mats the upper limit is considerably lower, as the asphalt has to work on by itself. Too low a consistency in both cases will result in its liquid asphalt draining away or being removed by capillary action.

After construction, the tendency of the liquid asphalt to migrate depends on its consistency, quantity present and degree of completion of the mat. The hardening of the bitumen results from the volatilization of the light oil components, absorption or possibly adsorption of the lighter fractions by the aggregate. Water resistance is also affected by the rate of hardening, tendency to emulsification and chemical attack being lessened by the strength and thickness of the bitumen film.

(*c*) The fundamental requirements of the binder are: (1) it must have proper consistency for mixing and shaping or penetration, (2) it must set up to a hard strong film of the proper amount for the particular job. Rate of drying must not be so great as to hinder construction, but must be fast enough to develop the type of film required before the opportunity for water or other destructive action occurs, and also before the sub-grade has reached a condition of minimum strength which would necessitate the full bearing power of the mats. Cut-backs have the advantage of easy adjustment to meet any consistency requirement, rate of curing and type of residue to be left, whereas with road oils only a compromise can be obtained, unless hot mix construction is employed. In addition to the loss of mat strength, the thinness and softer films provided by road oils decrease the resistance to water and also to chemical action.

2. *Priming Materials.* (*a*) The functions of the primer are: (1) waterproofing of the base, which requires a layer of sub-grade material completely saturated with bitumen, rather than a layer of bitumen on the sub-grade, (2) provision of a bond between the sub-grade and the mat, (3) increase of the effective thickness of the mat, (4) consolidation of loose material in the sub-grade to prevent areas of weakness, (5) physical and chemical stability

(*b*) The action of the primer depends on its consistency and adhesion tension being low enough to ensure penetration, but high enough to prevent unnecessary loss into the sub-grade. After application and during drying, the primer will tend to work back into the mat or penetrate into the sub-grade, depending on consistency, quantity present and voids in the mat, this being resisted by the hardening owing to volatilization, absorption or adsorption. Removal by evaporation of the lighter fractions will decrease the film thickness. Slow hardening facilitates migration by capillary action, whilst rapid hardening gives insufficient penetration, giving an undesirably rich surface layer. Displacement or water action can be prevented only if the material dries to form stiff strong films.

(*c*) The requirements of the primer are then : (1) sufficient consistency to give correct penetration, (2) correct rate of hardening to suit sub-grade conditions and to give hard strong films, as well as completely fill the capillaries to the desired depth. C. L. G.

1379. Grouting and Semi-Grouting with Cold Emulsified Bitumen. A. C. Hughes. *Surveyor*, 1935, **87**, 537–538.—Grouting and semi-grouting methods of construction of road surfaces by means of emulsion are described. A. O.

1380. Asphalt Road Surfacing Design. A. C. Hughes. *Contract Journal*, 1935, **113**, 27–28.—The British Standard Specifications for asphalt surfacing mixtures are reviewed. A. O.

1381. Lubrication of Steam-turbines. G. H. Richter. *Oel und Kohle*, 1935, **11**, 571–572.—Recommendations are made for the care and economizing of turbine oils. Impurities, *e.g.* water, abraded metal, etc., which catalyse ageing should be removed periodically by centrifuging; paint which is not entirely oil-resistant should not be applied to oil-ways.

Oil-ways must not be in the immediate neighbourhood of steam-pipes.

Emulsification may be inhibited if the oil-ways are flushed periodically with trichlorethylene, and if steam leakage at stuffing glands is minimized.

The oil should enter the cooler at $> 60°$ C., and should be cooled through 12° C. before re-circulation.

A method of calculating the charge of oil necessary to these conditions is illustrated. P. G. H.

1382. Rubber in Lubricants. H. P. Stevens, W. H. Stevens and M. B. Donald. *Bulletin of Rubber Growers' Association*, May, 1935. (*Oil & Colour Trades Journal*, 1935, **87**, 32.)—The addition of rubber increases the viscosity of mineral oils, and it is claimed that it reduces the coefficient of static friction and increases the resistance to sludging. Experimental figures are quoted in support of this. J. L. T.

1383. Lubricants in Gas Works. W. E. Gooday. *Gas J.*, 1935, **211**, 317–319.—The general principles of selecting and using lubricants for the various types of machinery in gas works are discussed. Particular reference is made to the requirements of steam cylinders, air compressors and turbines. J. L. T.

1384. Reclamation of Lubricating Oils, Air Service Practice. R. B. Walker. *Refiner*, 1935, **14**, 446–447.—The United States Government reclaims tens of thousands of gallons of airplane motor lubricants yearly. The procedure consists in settling, followed by heating to remove volatile matter, and finishing by filtration through pads. The original appearance of the oil is not restored, unless chemical treatment is employed, which refinement is considered unnecessary. B. C. A.

1385. Use of Bitumen as "Mineral Rubber" in the Rubber Industry. F. C. van Heurn. *Bitumen*, 1935, **6**, 121–125, 149–152.—The author reviews the literature dealing with the use of bitumen in the rubber industry and the origin of the term mineral rubber as applied to such bitumens. It is stated that natural bitumens such as elaterite and utainite were originally employed, but petroleum bitumens, particularly blown bitumens, are now the principal source of mineral rubber. Mineral rubbers are used to cheapen the cost of rubber mixtures, as softeners or plasticizers, to increase the ability to incorporate fillers, *e.g.* zinc oxide, lampblack, etc., and to increase resistance to the action of water and air. The mineral rubber must not reduce the elasticity of the vulcanized rubber compound, and must disperse in the rubber without

becoming granular, and be free from material volatile at the vulcanization temperature, whilst the hardness of the bitumen must be such that the bitumen can be worked on the rollers at the working temperature. The suitability of the dispersion of the mineral rubber in rubber is examined microscopically, whilst resistance to fracture of the vulcanized compound is examined by the method of Schaffer. A. O.

1386. Application of Bitumen in the Leather Industry. I. Vaisberg and S. Gerasev. *For. Petr. Techn.*, 1934, **2**, 10, 382–3.—Various hides were impregnated with a mixture (*a*) of 85% Grozny 90–120 bitumen, 10% Azneft petrolatum and 5% paraffin and (*b*) 85% Grozny bitumen, 5% Azneft petrolatum, 5% paraffin and 5% lard. The operation was carried out at 100° C., the hides being brought up to this temperature prior to immersion in the above mixture for 90 seconds. Various tests carried out with the above hides show that this method can be used successfully. G. R. N.

BOOK REVIEW AND BOOKS RECEIVED.

Review.

GEOLOGY OF NATURAL GAS. Edited by Henry A. Ley. xii + 1227 pp. 1935, American Association of Petroleum Geologists, Tulsa, Oklahoma: Thomas Murby & Co., London. $6.0.

THIS volume, the latest addition to the publications of the American Association of Petroleum Geologists, is, like its predecessors, a veritable mine of information, dealing as it does with all phases of the occurrence of natural gas in the North American Continent. The idea of assembling a comprehensive volume on the geology of natural gas originated some years ago with the late Sidney Powers and Frederic H. Lahee, and the result represented by the present publication, consisting of thirty-eight papers contributed by forty-seven authors under the Editorship of Henry A. Ley, is a worthy tribute to its originators.

By dealing with considerable areas often containing numerous individual gas-fields, it has been possible to eliminate much of the geological repetition which would otherwise have been necessary, without in the least detracting from the value of the details given.

It would appear that the original idea was a world-embracing volume, but that at a later stage it was decided to confine it to North America, and contributions dealing with other Continents and areas were diverted to the Bulletin.

It is impossible within the compass of a brief review even to touch on the mass of valuable detailed information recorded. There is scarcely any important fact relative to North American gas, be it stratigraphical, structural or statistical, that cannot be readily obtained from the volume.

The regional papers mainly take the same form, a description of the regional geology, stratigraphical and structural, followed by the more local features of the individual gas-fields in which is given a mass of detail as to production, potential reserves, reservoir pressures, etc., supplemented by ample references and bibliographies. As regards the latter, one might be permitted a word of criticism. In a volume such as this, which will be used in the main as a work of reference, it is perhaps a pity that the references to other literature and bibliographies have not been systematized throughout. In many cases these are given as footnotes, in others as unnumbered bibliographies at the end of the paper. Only in four cases is what the reviewer would consider the most generally useful system adopted—namely, a numbered bibliography at the end of the paper to which the reader is referred in the text. This is little, if any, inconvenience to the reader, but a great convenience to anyone wishing to scan the bibliography of a particular region.

The first three papers, pp. 1–111, deal with the Canadian Gas-fields, and, naturally, in the paper by S. E. Slipper dealing with Alberta, the problems of the Turner Valley are given due prominence, and it is interesting to note that that author postulates a Palæozoic origin not only for the Turner Valley gas, but also for the vast Athabasca "Tar Sands."

This is followed by thirty papers, pp. 112–995, on the gas-fields of the United States of America. While most of the authors restrict themselves strictly to descriptive and statistical matters, several touch briefly on more theoretical questions of origin and accumulation, especially with regard to the purely gas-fields.

Carey Cronies contributes an interesting observation in this connection—namely, that in the interior Highlands of Arkansas "all of the gas is being produced from beds which, judged only from the carbon ratios, have been too greatly metamorphosed to warrant the expectation of any gas at all."

The descriptive part of the volume closes with a paper on natural gas in Mexican Oil-fields, by John M. Muir, who gives some very interesting details of some of the carbon dioxide-yielding wells, and suggests a close connection between these and the dissolved carbon dioxide in the underlying salt water.

The next two papers deal with valuation of natural gas properties and a highly mathematical treatment of the estimation of natural gas reserves.

C. E. Dobbin contributes a very interesting account of the geology of natural gases rich in helium, nitrogen, carbon dioxide and hydrogen sulphide. He shows that

many of the rich helium gases occur close to crystalline rocks, strengthening the theory that the helium has, in some cases at least, been derived from the disintegration of radioactive elements, but he appears to leave unsolved the almost universal high nitrogen content of these helium-rich gases.

The final contribution, "Natural Gas," is by the editor, in which he deals ably with general statistical and especially economic aspects.

Though many problems obviously remain to be solved in connection with natural gas, the immense amount of accurate detail now made available must lead to a marked advance towards their solution.

Needless to say, as regards its general "get up" the volume conforms to the high standard one associates with publication of the A.A.P.G. JAMES ROMANES.

Books Received.

AMERICAN PETROLEUM INSTITUTE: PROCEEDINGS, FIFTH MID-YEAR MEETING. SECTION IV, PRODUCTION. 136 pp. 1935, New York, A.P.I. 50 cents.

The report of the proceedings of the Division of Production at the Fifth Mid-year Meeting held on May 14 to 16, 1935. Abstracts are given of the papers presented at the three sessions, together with a lengthy abstract of the "Review of Sub-surface Pressure Instruments." The Reports of the Standing Committees and of the Standardization Committees are included.

AMERICAN SOCIETY FOR TESTING MATERIALS: A.S.T.M. STANDARDS ON PETROLEUM PRODUCTS AND LUBRICANTS. 358 pp. 1935, A.S.T.M. Philadelphia, Pa. $1.75.

The latest edition of the A.S.T.M. standards pertaining to petroleum contains 57 test methods, 6 specifications (one for fuel oil and five for emulsified asphalt), and 2 lists of definitions of terms.

The report of Committee D-2 includes a discussion of work on the Sligh oxidation test, with a proposed method of test for oxidation number of lubricating oils by the Sligh method. A revised diesel fuel oil specification is also published for information.

A new method covers the vapour pressure of motor and aviation gasoline (Reid method), and a number of the standard and tentative methods have been revised in detail.

Copies of this publication can be obtained from the offices of the Institution, price 7*s.*, postage extra.

ATTWOOLL, A. W., and D. C. BROOME. TRINIDAD LAKE ASPHALT. 56 pp. Illus. 1935. London.

In the opening chapter the authors trace the history and development of the asphalt lake from the time of its first mention by Sir Walter Raleigh in 1595. The second chapter deals in considerable detail with the chemical and physical properties of the asphalt itself, whilst the following chapter is similarly concerned with the associated mineral matter, water and gas. The remaining two chapters are devoted to the utilization of the asphalt in the manufacture of asphaltic cement and typical specifications are given.

A useful bibliography is included, and some excellent pictures illustrating the operations in Trinidad.

HOKKAIDO IMPERIAL UNIVERSITY: JOURNAL OF FACULTY OF SCIENCE. SERIES IV, GEOLOGY AND MINERALOGY, VOL. III, No. 1. 100 pp. 1935.

Contains several papers on general geology of Japan and Manchoukuo.

JACKSON, L. C. LOW-TEMPERATURE PHYSICS. vii + 122 pp. 1935, Methuen & Co., London. 2*s.* 6*d.*

In dealing with the physics of low temperatures for this series of Monographs on Physical Subjects, it has been necessary to make a rigid selection, and to treat in detail only a few sections of the subject. The items discussed are the production of low temperatures, the measurement of low temperatures, liquid and solid helium, specific heats, electrical conductivity, and magnetism. The subject matter is generally restricted to the temperature range of 1–20° K.

THE MODERN DIESEL. x + 228 pp. Third edition. 1935. Iliffe & Sons, London. 3*s.* 6*d.*

This small textbook of the high-speed compression-ignition covers the whole development of the unit, from its inception to the latest type. The fuel-injection systems, cylinder-head design, and fuels are fully discussed, and the various types of engine are described in some detail. The operation of high-speed engines in service is dealt with. Particulars are given of special types for aircraft and marine service, and the diesel railcar is mentioned and its future discussed. The principal characteristics of modern engines are conveniently set out in tables. The book is illustrated with numerous photographs and line diagrams.

THE MOTOR INDUSTRY OF GREAT BRITAIN, 1935. 158 pp. 1935, Society of Motor Manufacturers and Traders, London. 2*s.* 6*d.*

Prepared by the Statistical Department of the Society, this book gives a mass of valuable statistics and data relating to all aspects of the motor industry. In 1904 the total number of motor vehicles in use in the United Kingdom was 17,810; in 1913, the figure was 207,878, and in 1934 it had risen to 1,874,013. In 1913 the estimated consumption of motor spirit was 101,049,061 gallons and in 1934 was 1,211,454,000 gallons.

REED, BRIAN. DIESEL LOCOMOTIVES AND RAILCARS. 190 pp. 1935, Locomotive Publishing Co. 6*s.*

The advantages and development of the diesel engine for traction purposes are dealt with in the opening chapters, followed by a discussion of the requirements for railway usage. The engine and its auxiliaries are then described, and brief descriptions of various types given. In dealing with transmission systems, general requirements are first discussed, and this chapter is followed by separate chapters on mechanical, hydraulic, and electric systems. In an appendix is given the formula for the resistance of diesel vehicles. The book is illustrated with 131 figures, which include many line drawings and graphs.

SMITH, P. H. DIESEL ENGINES: EXCESSIVE LUBRICATING OIL CONSUMPTION. ix + 85 pp. 1935, Constable & Co., London. 3*s.* 6*d.*

The diagnosis of and remedies for excessive oil consumption in heavy oil engines are dealt with from various aspects. The quality of the oil, the influence of breathers, reduction of over-oiling, rings, pistons, small-ends, and the crank-case are discussed in turn, and methods suggested whereby oil consumption may be considerably reduced.

TASMANIA DEPARTMENT OF MINES: LEFROY AND BACK CREEK GOLDFIELDS. E. Broadhurst. Geol. Surv. Bull. 42. v + 87 pp. Pl. XIII. 1935, Government Printer, Hobart. 2*s.* 6*d.*

MATHINNA AND TOWER HILL GOLDFIELDS. K. J. Finucane. Geol. Surv. Bull. 43. v + 132 pp. Pl. XIV. 1935, Government Printer, Hobart. 2*s.* 6*d.*

In both of these bulletins the opening chapters discuss the history, geography and physiography, geology, and economic geology of the area, and are followed by detailed information regarding activities in the individual mines.

U.S. BUREAU OF MINES: INFORMATION CIRCULAR 6850. PETROLEUM REFINERIES, INCLUDING CRACKING PLANTS, IN THE UNITED STATES, January 1, 1935. G. R. Hopkins and E. W. Cochrane.

Full details of the refineries of the United States are given. On January 1, 1935, the number of refineries in existence had reached a record of 638. Of these, 435 were operating, 196 shut down, and 7 in course of erection. The total daily capacity of 4,072,400 brls. was also a record, the figure for the operating refineries being 3,614,749 brls.

The daily charging capacity of cracking plants was 2,229,269 brls., the highest figure yet recorded. Operating plants had a capacity of 1,897,778 brls., shut-down plants 311,491 brls. and plants under construction 20,000 brls.

ABSTRACTS.

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Class 100. Geographic Occurrence.

1387. Alberta Oil and Gas Development. W. Calder and R. M. S. Owen. *J.I.P.T.*, 1935, **21**, 753–773.—An authoritative account, with bibliography, on the production of oil and gas in Alberta and the methods employed in this connection. G. R. N.

1388. Petroleum in Gabian (Hérault). L. Barrabé and D. Schneegans. *Ann. des Comb. Liq.*, 1935, **10**, 595–662.—A complete report is presented regarding the geological conditions and the work carried out, under state control, in this territory. The article is furnished with maps and much detailed information. W. E. J. B.

1389. Petroleum Industry in Japan. M. Matsuda. *Mon. Petr. Roum.*, 1935, **36**, 1379–1384 and 1459–1463.—The author sub-divides the history of the development of the industry into three sections, viz. 1868–1887, 1888–1912 and 1912–1921. The first period saw the opening of the Japanese ports to external commerce, and the use of petroleum for illumination purposes grew rapidly. In 1872 an American geologist examined the possibility of oil occurrence in Japan, and wells were sunk in Shinano and Yechigo, and in 1887 production realized 4711 tonnes. The second period saw the rapid development of the home industry until, in 1912, 226,692 tonnes were produced. This, in general, was poorly refined, and suffered in comparison with imported oils from America and Russia. Consumption was mainly for illuminating purposes. Legislation was undertaken also in this period to protect the home industry. The third period saw a sudden increase in home oil production, caused by the introduction of modern methods in regard to drilling and prospecting. For example, at Kurokawa during 1914 a daily production of about 1550 tonnes was attained. The peak of home production was reached in 1915 with 405,860 tonnes; the falling curve of home production and the increasing consumption of petroleum products in Japan were balanced by increased foreign imports. In 1933, for example, 3,697,370 tonnes of petroleum were consumed.

The author then reviews the present state of the Japanese petroleum industry, giving the number of prospections in various areas and the number of completions, as well as production figures for various regions. Consumption figures are given for the period 1929–1933, as well as imports over this period. The customs bans applying to the importation of petroleum products are explained in detail. Finally, the national policy of Japan re petroleum is outlined. W. E. J. B.

Class 200. Geology and Origin.

1390. New Oxford Deep Zone in Kansas. F. Swindell. *Oil Weekly*, 7.10.35, **79** (4), 43–46.—This is one of the Nemaha granite ridge pools in Sumner County, Kansas. It was discovered in 1927, when a well gave 150–200 brl./day of oil from the Stalnaker sand of the Douglas upper Lancing group (lower Pennsylvanian) at 2012–2060 ft. deep. By the end of 1929 five producing sands had been established: the Emporia limestone at 1063 ft.; the Howard limestone at 1265 ft.; the Severy shale at 1305 ft.; the Hoover sand at 1605 ft., and the Stalnaker sand. Early this year a well was deepened below the Stalnaker sand and obtained oil at a depth of 2899 ft., 10 ft. below the top of the Ordovician pay. The identity of this new producing horizon is in doubt. Some correlate it with the Simpson dolomite, others with the Arbuckle (siliceous) lime, whilst others consider it a dolomite streak or zone of Arbuckle age. Fragments show both dolomitic and siliceous lime characteristics.

The average depth of the eleven wells deepened to this zone is 2835 ft., and the average penetration into the productive zone is 51 ft. It is assumed that the structure of this Ordovician horizon is similar to that of the Stalnaker sand, which has two relatively small domes, separated by a rather narrow saddle. There is evidence that the productive zone will not be more than one-third of a mile wide and not more than one mile long. The indications are that the beds below the Pennsylvanian are truncated. Some of the limestones encountered in drilling are cavernous.

Little gas is present, but it has a high H_2S content. The gravity of the oil is 38–39·5° A.P.I. Water drive seems to exist, and a short productive life is anticipated for this horizon. G. D. H.

1391. Round Mountain Field. A. Diepenbrock. *Sum. of Operations, Calif. Oil-fields*, 1934. 2nd Quarter, **19** (4), 5–15.—The Round Mountain oil-field is on the east side of the San Joaquin Valley, 11 miles N.E. of Bakersfield in Kern County. The field is made up of two separate producing areas: Round Mountain, in which there are 38 producing wells, and Coffee Canyon, with 30 wells. The former area was proved productive in May 1927, and the latter in August 1928.

This summary gives the history, stratigraphy, structure and underground conditions of the field, together with maps and plates illustrating the area and sections of the formation. Most of the wells were drilled with rotary tools. Circulation is frequently lost, and to avoid this, cable tools were used to drill several wells, but operators went back to rotary tools, as it was found that little trouble is experienced in drilling without mud fluid returns to the surface. The average rotary-drilled well can be completed in less than 30 days. Depths of wells range between 1600 and 2200 ft. Heaving sands seriously interfere with bailing tests for water shut-off in Vedder sand wells, even though a cement plug is placed below the casing shoe, but generally few wells at Round Mountain have failed to obtain a water shut-off by the first cement job. Drilling costs are low, but construction of roads and derrick foundations is expensive because of the steep hillsides. The formations are easy to drill. The majority of the wells at Round Mountain are pumped with light steel walking beam actuated by reduction gears electrically driven. Portable pulling and bailing outfits are used on the larger properties. Rugged topography prohibits using central power plants. Because production of the field is sharply curtailed, some wells are pumped only about half time each month, others remain shut down. Coffee Canyon wells are pumped continuously because they all produce a large amount of water, some as much as 95% of the total fluid. Electric dehydrators furnish the most economical means of treating a very tight emulsion in this oil. The emulsion in the oil produced from all other fields of the general area breaks down readily when heated.

Up to 1st July, 1934, Round Mountain has produced a total of 2,236,175 brl. of oil from 38 wells. At present the area has an estimated potential of about 11,000 brl. daily. The allotment of approximately 4000 brl. daily is conducive to good operating practice.

Coffee Canyon has produced a total of 2,472,336 brl. to 1st July, 1934, from 30 wells. Production per acre has amounted to about 15,400 brl. As a whole the area has more than returned the initial investment, plus operating costs, although some of the leases have undoubtedly been losing ventures because of the large volume of water which must be lifted with the oil. W. W.

1392. Rocky Mountain Crude Oil Reserves. W. W. Boyer. *Oil Weekly*, 28.10.35, **79** (7), 19–26; 4.11.35, **79** (8), 24–29.—The Rocky Mountain area comprises Montana, Idaho, Wyoming, Colorado, Utah, N.W. New Mexico, and N.E. Arizona. Eighty-two fields are known, but 14 have only one well and are undeveloped for lack of market. They are also small. In several fields lower sands have been proved productive by one or two wells, but are shut in until markets improve. Salt Creek (Wyoming) is the most prolific field, but Cut Bank (Montana) exceeds it in area.

The oil produced is commonly divided into two classes, light oil and black oil (sulphurous), the former, with few exceptions, coming from Jurassic or younger beds and the latter from Triassic or older beds. The reserve of light oil is estimated at 258,321,600 brl., and of black oil at 253,217,000 brl., a total sufficient to supply the region's own needs for 30 years at the present rate of consumption.

Of the twelve Montana fields only seven have reserves of value. The deepest Cat Creek well penetrates the Quadrant formation, no well having reached the Madison limestone. Cut Bank on the west of the Sweetgrass Arch is in active development with 30,000 acres proved. Productivity appears to be due to lensing of the Cut Bank sand against the arch and to varying porosity. There is rarely sufficient gas pressure to give natural flow. Dry Creek in southern Montana obtains gas and oil from the sands in the Frontier formation and the " Dakota group " of upper Cretaceous age. A well to the Tensleep sand found water only. Kevin-Sunburst produces from the Kootenai, basal Ellis and top of the Madison limestone. Acid treatment was found to revive and increase Madison production. Soap Creek produces black oil from the Amsden and the Madison limestone, but is shut in. New fields may be discovered on the Sweetgrass Arch, but there is little hope of large new fields in the Cat Creek–Devils Basin area and the Big Horn Mountains–Pryor Mountains–Hailstone Arch zone.

Colorado has 13 fields, of which Florence is the largest. This has relatively shallow wells (2200 ft.) producing from crevices and cracks in the shale. Fort Collins and Wellington lie on the same anticline, and produce from about 4500 ft. depth. Production may be found below the Morrison. Iles dome, in North-west Colorado, produces from the Nugget sandstone (Jurassic). The Rangely dome has one deep well to the Pennsylvanian Weber formation which gave 200 brl. of black oil per day after shooting. In the Walden district production was found on both north and south McCallum anticlines, two wells giving high gravity oil with large quantities of carbon dioxide. Deep new production is possible in Colorado from Pennsylvanian or older beds.

In N.W. New Mexico the Hogback dome produces from the Dakota sandstone; the Rattlesnake dome from the Dakota and upper Pennsylvanian. Gas is produced from the Dakota at Barker Creek and Ute domes.

The major reserve of Wyoming is in black oil-fields, estimated at 246,717,000 brl. against 157,734,000 brl. of light oil. Salt Creek has an undeveloped Tensleep reserve. All the other sands of this field, excepting the Second Wall Creek, are subject to hydrostatic pressure and rapid water encroachment. Lance Creek produces mainly from the Dakota group. One well has obtained good production from the upper Sundance and also from the lower sandstone member of this formation. At Rock Creek also deep Sundance production has been found. Little oil was produced from the Dakota at Medicine Bow, but the basal Sundance has a probable productive area of 2000 acres.

Lost Soldier and Grass Creek produce light oil from the Tensleep, and hopes are held for Madison production at Grass Creek (it is eroded at Lost Soldier).

Fourteen well-closed domes have been proved for black oil in the Big Horn Basin. Black oil is produced in the Oregon Basin from the Embar and Tensleep, and the Madison limestone has shown oil. No commercial oil-fields have yet been discovered in N.E. Arizona, Utah and Idaho. G. D. H.

1393. Geology and Economic Significance of Hobbs, New Mexico, Field. B. B. Zavoico. *World Petr.*, 1935, **8**, 459–472.—The development, economic significance and geology of the field are discussed. Drilling and production practices in the area are outlined and data on recovery costs presented. The decline of reservoir pressures in field has been very slow, and up to 1st June, 1935, the pressure has fallen from the original of around 1510 lb. to 1320 lb., a fall of 190 lb. in 5 years, during which time some 58,000,000 brl. of oil have been produced. It is estimated that some 120,000,000 brl. remain to be recovered. The field is a remarkable example of orderly oil-field development and of co-operative effort on the part of producers. W. W.

1394. Canadian Wildcats. Anon. *Oil Weekly*, 21.10.35, **79** (6), 49–50.—Exploratory drilling is proceeding in nine areas in Saskatchewan. At Hudson Bay Junction a well encountered a thick, heavy, viscous substance carrying oil at a depth of 1200 ft. In the Kakwa area most of six preliminary tests have encountered a gas and water sand at about 275 ft. Thirty-five miles east and a little south of Lloydminster, three tests have shut off apparently commercial gas sands in an effort to find oil at greater depths. Lloydminster is Saskatchewan's newest commercial gas-field, its three wells having a maximum daily capacity of 69 million cu. ft. At Riverhurst, 40 miles north-west of Moose Jaw and 40 miles north-east of Swift Current, four test wells found gas at 520 ft. A test at Maple Creek was abandoned at 2100 ft. after recording good showings of gas. G. D. H.

1395. Geophysical Programmes in Gulf Coast District. Part I. B. Mills. *Oil Weekly*, 7.10.35, **79** (4), 21.—A new technique in geophysical surveying has been developed in the Texas–Louisiana Gulf Coast to deal with the flat area offering few elevations in sharp surface contrasts. In some parts, such as Wyoming, California, and parts of Mid-Continent, little preliminary work is needed, as most of the structures either show plainly at the surface or are easily mapped. The Gulf Coast strip presents the exact opposite in surface contrasts, and as a result this district requires the most elaborate preliminary programme of any producing district in the world.

The oil accumulations in the Gulf Coast are closely associated with the salt domes, and these domes play a big part in the determination of an area.

Various methods are used for the determination of these plugs. In the early stages of exploration work reflection seismograph is favoured by many companies. To the

long strip lying between the flat coastal plain and the hilly section a combination of surface geology and geophysics is being applied. Torsion balance and refraction seismograph have also been used successfully. L. V. W. C.

1396. Method of Geo-electric Exploration. J. N. Hummel. *Oel u. Kohle*, 1935, **11**, 648–651.—Electrodes are lowered by insulated cables into two neighbouring bore-holes. The specific resistance of the stratum at any one depth is measured by known methods, the results being recorded continuously as the electrodes are lowered. The records afford information as to the constitution of the strata and indicate the presence of liquid deposits. P. G. H.

Class 300. Development and Production.

1397. Fitts Pool's Early Development. K. R. Teis. *Petr. World*, 1935, **32**, 146–150.—Deals principally with the treatment of the problems encountered in the drilling operations in the Fitts Pool field, which is situated in the Southern Pontotoc County, Oklahoma. Discovery of the field dates back to the drilling of No. 1 Wirick, which was completed in August 1933. There are now approximately 80 producing wells, totalling a daily tubing potential of about 280,000 brl. Average depth of wells is 4300 ft., and two casing strings are used, 500–600 ft. surface string of either 13⅜-in. 54½ lb. or 12½-in. 50 lb. Grade C seamless pipe. In most cases the oil string is 7-in. 24 lb. seamless casing. Subsurface pressure January 1935 averaged 1776 lb./sq. in. at 3300 ft.

Surface hole is made with 11-in. bit and reamed to 17½ in. In some wells the 11-in. hole has been carried to the top of the Viola limestone, whilst in others a reduction to 8¾ in. is made at about 2000 ft. Wells are drilled in with 6¼-in. bits. Approximately 50 bits are used per well, of which about seven are used below the oil string. Drill-pipe twist-offs are quite prevalent—averaging about one per well. Circulating pressures range from 750 to 800 lb./sq. in. Considerable trouble from blow-outs has been experienced.

Operators have found considerable difficulty in placing an impervious body of cement behind the casing, probably due to migration of gas during cementing operations. Complete loss of returns are common when cementing with 2000–2400 sacks. Several experiments have been made to determine the ratio of actual cement required for complete circulation to the theoretical amount based on drill-hole diameter and O.D. of casing. One operator placed 10 lb. of ordinary rice in the mud stream, catching the rice on a screen on its return to the surface.

Two wells have been completed with pressure-drilling equipment, using clear water as the drilling fluid. The prime object to be attained in this type of pressure drilling is the maintenance of pressures on bottom, which permit the well to produce throughout the drilling operations. This is accomplished by the use of drilling fluid made light by gas aëration. The drilling-in of these two initial wells by the pressure method has proved the system entirely practical for use in the Fitts Pool. W. W.

1398. Pressure Drilling in Oklahoma. J. S. Ross. *Petr. Eng.*, October 1935, **7** (1), 42.—The pressure in the Wilcox Sand in the Oklahoma City field is such that considerable penetration of the drilling mud must take place unless drilling is done under pressure.

Drilling-in under pressure permits the pay zones to be accurately logged, and small increases in rates of flow of oil and gas can be promptly detected. For plugging back operations, a knowledge of the exact location and content of the producing horizon is invaluable.

The pressure method enables more hole to be made than is possible when drilling-in with mud, due to the fact that the hole is always kept clean of cuttings and no settling of cuttings occur when changing the bit.

The ordinary drill-string is employed with packing around the rotating square kelly joint, accomplished by means of a fully self-aligning drilling head coupled to a special high-pressure oil saver and blow-out preventer. L. V. W. C.

1399. Small-Size Pipe and Inside Cutter Aid in Recovery of String of Drill-Pipe. N. Williams. *Oil & Gas J.*, 12.9.35, **34** (17), 45.—Extra small-sized drill-pipe, which can be run and handled through the normal-sized drill-pipe, is being increasingly used on the Gulf Coast. In one case a string of 4½-in. O.D. pipe which had become stuck at 8003 ft. in heaving shale was separated at 6884 ft. in one cut by using an inside cutting

tool and a string of this small pipe. The small drill-pipe was 1¼-in. O.D., 4·2 lb. pipe made up in 30 ft. joints, and the total time required was 12 hours, the actual cut taking only 20 minutes.

This is the first instance of cutting pipe, other than tubing, with an inside cutter, as previously outside cutting tools on strings of casing had been washed down over the outside of the pipe, and not more than 500 ft. could be cut at a time by this method.

The cost of the inside cut in the instance mentioned above was $850, which included $600 rental for the inside cutting tool and the drill-pipe.

This small-sized pipe has also been used for drilling out cement plugs in small diameter strings and in the cutting and recovery of tubing, and has proved very useful.

L. V. W. C.

1400. Drilling Equipment for Deep Wells. G. Wade. *Oil News*, 1935, **37**, 265–269, 308.—Outlines the data given in U.S. Bureau of Mines Tech. Paper 561 on the drilling equipment in the Oklahoma City field, where the minimum depth of wells is about 6500 ft. and usual gas pressure was about 2600 lb./sq. in. Data cover construction details of derrick foundations, sizes and design of derricks, with their weights and safe load capacities, and sizes and details of drilling engines, draw-works, rotary tables, crown blocks and travelling blocks. Weights of these pieces of equipment are given, also the approximate prices prevailing in 1930.

W. W.

1401. Convertible Drilling Rig. F. Swindell. *Oil Weekly*, 7.10.35, **79** (4), 48.—A combination rotary-cable tool outfit has been developed and used in Western Kansas. The rig consists of two units, the unified draw-works mounted on one skid, and the power, cable tool and pump unit mounted on another. The rotary rig does not differ considerably from any other unified draw-works.

The change over from rotary to cable tools is a simple matter, and there is little delay when such change over becomes necessary to enable drilling to be done through the porous beds where circulation is difficult.

L. V. W. C.

1402. New Diesel-Electric Rig. A. H. Rowan. *Oil Weekly*, 7.10.35, **79** (4), 29.—A new type diesel-electric rotary rig possessing several interesting features is being used in the Monument field, New Mexico.

Two 6-cyl. engines are connected to 200-kw., 200-v., 1200-r.p.m., D.C. generators. The auxiliary unit consists of a 6-cyl. engine direct connected to a 25-kw., 115-v., 1200-r.p.m. exciter, from air tanks mounted on a common skid, together with a two-stage, vertical air-cooled air compressor driven by a five horse-power motor.

The engines are of extremely rugged construction, and the fuel injection system is of the common rail solid-injection type. A duplex fuel pump, consisting of cam-driven plungers and an adjustable relief valve, maintains a constant pressure on the fuel supply header.

Fuel-oil filters are provided for each unit, and as an additional precaution a pipe-line strainer has been installed between the fuel tank and the fuel oil pump on the pump.

L. V. W. C.

1403. Equipment Corrosion in Kansas Wells Retarded by Chemical Treatment. L. G. E. Bignell. *Oil & Gas J.*, 3.10.35, **34** (20), 32.—Severe corrosion of iron and steel oil well equipment and surface water and oil-handling equipment in lime formation fields in West Kansas is being retarded by : (1) Use of wooden tanks ; (2) Use of asbestos compound or cement-lined pipe between well-head and tanks or separators (which reduces also the precipitation of salts), and provision of external coating of pipes against soil corrosion ; (3) Painting inside and bottom of tanks with hot blown bitumen or cement, placing a sheet of metal in the flow to prevent the oil stream from damaging the layer ; (4) Covering bottoms of tanks on corrosive soil with asbestos base paper affixed with hot asphalt ; (5) Prevention of scale formation in tubing (which increases weight and reduces its strength) by reduction of acidity of well water with sodium cresylate (patented process). Caustic soda has the disadvantage of reacting rapidly with Ca and Mg salts, thereby becoming neutralized rapidly and depositing salts, so that large quantities are required. Sodium cresylate, however, reacts more slowly, allowing rapid diffusion through the water in the well while also preventing corrosion, the oxygen not being set free in acidic condition. The cresylic acid formed by the chemical reaction helps to keep the tubing and pumps free from oil films. The precipitates formed adsorb the oil from the well to some extent, and are thus removed by the pump.

In special cases, where the corrosion is of the oxidation type and H_2S is absent, a dichromate, chromate, chromous or chromic acid may be used. This is particularly advantageous with water high in bicarbonates of Ca or Mg, the carbonate of which would be precipitated with sodium cresylate. In order to increase the speed of diffusion through the water, NaCl is added to the reagent until its specific gravity is the same as that of the water. 90% or more of the reagent solution is added between the casing and tubing as rapidly as possible after the pump is shut down, the remainder being added about 18 minutes before the well is pumped off. For continuously-pumped wells the requisite quantity of reagent is added continuously. It may be possible to reduce the amount of treatment by shutting off the corrosive bottom water by plugging the lower part of the hole.

In order to keep the precipitate in such form that it is easily pumped from the hole with the fluid, one of a number of reagents may be added (including alkaline salts of tannic acid and the like, and alkaline solutions capable of reacting with Mg, Ca, Sr and Ba salts to give light flocculent and even gelatinous precipitates, *e.g.* Na aluminate or silicate). To prevent slow crystallization of alkaline-earth sulphates in the presence of chlorides, sodium sulphate is added, causing the rapid precipitation of fine sulphate salts. Examples of the different types of chemicals used under different conditions are given.

A further use of chemicals in retarding corrosion is the spraying of aluminium paint on the underside of the decks of steel tanks to prevent iron sulphide formation. Coating of the bottom of the tank with cement or an asphaltic compound will also prevent the danger of any slabs of iron sulphide which fall from the deck striking the sheet tank bottom. C. L. G.

1404. Unusual Casing Practice. E. S. Post. *Oil Weekly*, 23.9.35, **79** (2), 37.—A new casing practice for deep well formation testing has recently been devised, and resulted in the establishment of a new South Texas field.

In the well in question it was necessary to work over an abandoned well bottomed at 7508 ft. and to test sands above that level. Washing down and re-working appeared likely to cause complications, and it became necessary to protect the possible producing horizons.

The hole was first washed down 6856 ft., and a 4-in. string with a drilled bull plug screwed to the bottom was run into the hole to cement the next 80 ft. On the completion of the cementation the hole had a depth of 6776 ft.

A 500-ft. string of 7-in. O.D. casing was then set on bottom with the lower 20 ft. of the casing blank, and the next 90 ft. perforated with ¼-in. holes. The next 30 ft. was blank pipe, and above this was the set up for a full hole cementing job, including a baffle collar and a canvas basket.

After the completion of the cement job a regular full hole testing tool, choked bottom and top, was run into the hole. An accident occurred, however, during this operation, and the well got out of control.

It was then decided that the well should be completed with the drill string in the hole. The drill stem was welded to the top of the casing and the well completed as a large gasser. L. V. W. C.

1405. Viscosity and Stability of Drilling Fluid. C. W. Woolgar. *J.I.P.T.*, 1935, **21**, 825–837.—An account of experiments on the viscosity and stability of some drilling muds in which use was made of a Stormer viscometer. The results indicated the stability of the mud was not so important as had been supposed. G. R. N.

1406. Slush Pump Hookup. F. Swindell. *Oil Weekly*, 23.9.35, **79** (2), 35.—As a means of saving fuel and water for drilling purposes the slush pump on one rig in operation in the Oklahoma field has been direct connected to a steam engine, and instead of steam being delivered to the pump, it is piped to the engine. This has resulted in the power requirements of the rig being reduced, and only two 100-h.p., 150-lb. working pressure boilers are required. L. V. W. C.

1407. Completing Wells with Oil. B. Mills. *Oil Weekly*, 30.9.35, **79** (3), 43.—For drilling-in low-pressure wells in the Joiner Area of the East Texas field, the use of oil has been found to be a very profitable practice. Using drilling fluid resulted in a number of wells producing less than expected, and a more steady tendency to produce and more life were shown when the wells were completed with oil.

After setting the 7-in. casing, the mud in the hole is replaced with crude oil, about 140 brl. being required to replace the drilling mud. The quantity will, of course, vary with the depth of the hole.

The oil returns from the well are passed to an oil tank of three compartments equipped with baffles. The oil enters the first compartment, and most of the cuttings are permitted to fall. It then passes over the baffle into the second compartment, where further cuttings fall, and finally enters the third compartment, from which it is drawn by the pump suction. L. V. W. C.

1408. Dual-Lift Method of Producing Oil is Successful in Oklahoma City Field. H. C. Ihrig. *Oil & Gas J.*, 26.9.35, **34** (19), 53.—A combination of an electric submergible centrifugal pump and gas lift is used on the deep pumpers in the Oklahoma City field. The pump is a 92-stage centrifugal pump run by a 97½-h.p. motor of the 2-pole 60-cycle type operating at 440–880 volts and 3600 r.p.m.; it will produce up to 1000 brl./day, and will run for 30 days without attention.

A hook wall packer is run on 2½-in. tubing to about 5500 ft., and the pump suspended from this packer on 2-in. tubing and set as close to bottom as possible. The 2½-in. line is perforated above the packer, so that oil pumped up from the bottom of the hole emerges into the annular spacing and is gas lifted to the surface. A special adapter is fitted to the packer, enabling the electric cable to run down the outside of the 2½-in. tubing, enter the inside of the packer at the top and re-enter the annular spacing at the bottom.

The special methods of running, pulling and operating this type of hook-up are described, and some working costs are given. Using the centrifugal pump alone, production varied from 800 to 1000 brl./day with a power charge of 2½ kw. per brl. Using the combination of pump and gas lift, production increased to 2400–3200 brl./day, with a power cost of 1 kw. per brl. and an input gas/oil ratio of 600–700 cu. ft. of gas per brl. L. V. W. C.

1409. Air Venting of Gravity Systems. E. Sterrett. *Oil Weekly*, 28.10.35, **79** (7), 28.—The entry of air into a gravity gathering system may cause considerable difficulty in control.

It is possible to prevent this trouble by the installation of a master check valve close to the tank manifold, and lateral check valves on the lateral lines placed close to the main line.

Any air entering through a given tank would be carried to the main line, and would be prevented from working back into the lateral lines by the lateral check valves. The entrapped air would then work its way back to the master check valve, and by means of a by-pass line surrounding the master check valve the air can be released by opening a valve on the by-pass when the main tank gate is opened.

L. V. W. C.

1410. Review of Sub-surface Pressure Instruments. D. G. Hawthorn. *A.P.I. Prod. Bull.* No. 215, May 1935, 11.—Rapid progress has been made during the past few years in the development of instruments for measuring sub-surface pressures in oil and gas wells. There are now some eight or ten different kinds of instruments which have been developed to the practical stage. These instruments are classified and described, and the testing procedure is briefly reviewed. W. W.

1411. Gas Used to Repressure Pennsylvania Field in Lieu of Either Air or Water. R. C. Conine. *Oil & Gas J.*, 26.9.35, **34** (19), 41.—Gas is to be used instead of air in repressuring operations in the Warren district of Pennsylvania, as the use of air caused oxidation of the oil with an increased viscosity. If the gas repressuring fails, then water flooding will be resorted to.

The total acreage is about 300, and development is on the five-spot pattern with a spacing of about 400 ft. between producing wells, of which there will be fifteen when the scheme is finished.

The two producing sands are found at 1310–1380 ft. and 1420–1503 ft.; about 10,000 cu. ft. of gas will be injected into each inlet well per day at 400 lb./sq. in. pressure. The initial production per well is only about 7 brl./day, but the estimated recovery is about 18,400 brl./acre. L. V. W. C.

1412. Magnolia's New Type Repressuring Plant Sustains Reservoir Energy. Anon. *Oil & Gas J.*, 12.9.35, **34** (17), 38.—This repressuring plant was put down to conserve

reservoir energy and to increase the production flow and the ultimate recovery, the whole to be done at a reasonable cost per barrel. The unit consists of a compressor capable of returning all the gas from the producing wells into the key repressuring well, and a band-wheel power-pumping outfit. The compressor unit is designed for handling 243,000 cu. ft. of gas per day at 1500 lb./sq. in. discharge pressure, and requires 77 h.p. to do this. At present it is handling only 90,000 cu. ft. per day at 900 lb. pressure, and is using 65 h.p.

The band-wheel power-pumping plant is a 24-ft. " PW " Reid unit with two 24-in. throw eccentrics, and requires from 25 to 35 h.p. It will serve 10–15 wells of an average depth of 2800 ft.

Power for both units is furnished by a 100-h.p. 2-stroke 2-cyl. gas engine, which drives the two Ingersoll–Rand compressors and the band wheel through a countershaft. The plant has worked very successfully, and it is probable that this type will become quite popular. L. V. W. C.

1413. Selection of the Proper Equipment for Repressuring Operations. K. B. Barnes. *Oil & Gas J.*, 12.9.35, **34** (17), 54.—After deciding on the particular repressuring operations to be carried out, the equipment to be used must be considered carefully to obtain economical pumping costs. For instance, the balancing of powers in central pumping will often result in appreciable monetary saving.

Large-scale operations are necessary for low working costs, and it will often pay various small operators to combine to build a large central plant serving their various leases.

Gas/air mixtures must be very carefully controlled and handled, or an explosion may result and severe damage be done. For economical operation the optimum quantity of gas injected and given out per barrel of oil produced must be used, and a check must be kept on these quantities, preferably by means of orifice meters, to see that they remain within the limits found by experiment to be best. L. V. W. C.

1414. Repressuring Project. J. C. Albright. *Oil Weekly*, 14.10.35, **79** (5), 19.—A repressuring project has been commenced near Oil City, Pennsylvania, by the National Petroleum Corporation. Some of the oldest wells in this district have been taken over, some are being reconditioned, whilst new ones are being drilled when necessary for input wells. The wells are drilled through producing sands and bottomed in the impervious and non-producing formation below the black sand.

Only one string of casing is used, 6¼-in. pipe set at 270 ft. The drilling is done with a small portable gasoline-powered rig, using cable tools and shear legs for handling the casing.

Two-inch tubing is run in with a bottom-hole packer to effectively seal off water from the producing formation. After the tubing has been tested and found gas-tight, the annular space between the string and the walls is filled with mud.

A string of 1-in. tubing is then run into the hole with two packers to seal off the sand from the producing formations. The 2-in. string handles the production from the upper horizon, and the 1-in. tubing the production from the lower.

Air is used as the repressuring agent, and is furnished by a centrally located plant so designed that pressure and pumping power may be obtained simultaneously and with the same engine. This air is boosted to 40 lb., after which it is cooled and returned to the high-pressure cylinder. It is discharged at 230–250 lb. directly to the input wells without cooling. Moisture is removed during the first stage. L. V. W. C.

1415. Cleaning Intake Wells. J. C. Albright. *Oil Weekly*, 23.9.35, **79** (2), 24.—One of the most important items to consider in operating flood properties in the Bradford field, Pennsylvania, is the quality of the water injected into the sand. It is found that the most favourable water will, under certain conditions, form an impregnable film on the sand face which builds up a resistance to the flow of water, greatly increasing the input rates.

As a means of overcoming this trouble many companies are using hydrochloric acid as an aid in cleaning the sand face.

Two methods of using acid are described, and it is reported that in a number of cases the wells treated take a greater amount of water than before being cleaned.

L. V. W. C.

1416. Treatment of Water for Domestic Purposes in a Trinidad Oil-field. A. H. Richard. *J.I.P.T.*, 1935, **21**, 871–886.—A paper, with discussion, presented at the Trinidad branch describing a water purification plant such as is considered necessary for isolated camps. G. R. N.

1417. Patents on Drilling Equipment. H. N. Herrick and W. G. Miller. U.S.P. 2,015,851, 1.10.35. Pressure and temperature recorder.

C. Schlumberger. U.S.P. 2,015,873, 1.10.35. Apparatus for sampling the formation in bore holes.

G. A. Humason. U.S.P. 2,015,938, 1.10.35. Air-lift apparatus.

M. J. Lewis, U.S.P. 2,016,042, 1.10.35. Knuckle joint for deviated drilling.

C. E. Bannister. U.S.P. 2,016,066, 2,016,067, 2,016,068, 1.10.35. Well drilling device for operating bit at the bottom of the hole.

G. A. Humason. U.S.P. 2,016,433, 8.10.35. Fluid-lift device.

I. J. McCullough. U.S.P. 2,016,607, 8.10.35. Rotary jar.

A. Lincoln. U.S.P. 2,016,641, 2,016,642, 8.10.35. Oil gas and water separator.

R. E. Moore, U.S.P. 2,016,683, 8.10.35. Fishing tool.

W. L. Church. U.S.P. 2,016,919, 8.10.35. Method for cementing and testing wells.

C. L. McGuffin. U.S.P. 2,017,033, 8.10.35. Manifold valve for slush pumps.

T. J. Adkins. U.S.P. 2,017,174, 15.10.35. Hook-off device for Jack pumping power lines.

W. L. Church. U.S.P. 2,017,434, 15.10.35. Packer and setting tool.

H. P. Wickersham. U.S.P. 2,017,451, 15.10.35. Packing casing bowl.

T. L. Bailey and W. S. Wiebusch. U.S.P. 2,017,522, 15.10.35. Coring apparatus for geological surveying.

W. F. Blucker. U.S.P. 2,017,581, 15.10.35. Safety hook for well torpedoes.

D. M. Hammett. U.S.P. 2,017,694, 15.10.35. Oil-well pumping apparatus.

C. E. Heeter. U.S.P. 2,017,717, 15.10.35. Stuffing-box casing-head. L. V. W. C.

Class 400. Transportation, Storage and Distribution.

1418. Protective Coatings for Underground Pipes. A. B. Densham and F. C. Smith, *Gas J.*, 1935, **211**, 567–577.—Details are given of an investigation of the efficiency of various coatings in protecting underground pipes from corrosion. The authors state that corrosion in gas service pipes and mains may be due to the action of soil water or to electrolytic action of stray electric currents, protection against the former being sufficient in country districts, but both types have to be considered in towns. The only absolute method of testing a coating is to bury a coated pipe for a long period, but for practical purposes accelerated tests are required. The characteristics to be considered are: resistance to water penetration, decay, and mechanical damage. The former can be measured by determining the resistance to diffusion of a dissolved electrolyte when the coating can be obtained in the form of a film or can be supported on a porous diaphragm. Coatings on pipes can be investigated by measuring the electrical resistance between the pipe and water in contact with the coating; certain difficulties, which are discussed, are encountered in this connection, and for this reason a 15-cycle A.C. megger was used. In England the reinforcing fabrics are the only components of coatings liable to decay, but these are not appreciably affected when well impregnated with pitch or bitumen. Resistance of coatings to damage by a blow can be investigated by allowing a standard blunt chisel to fall from a given height and remeasuring the electrical resistance. The tendency for coatings to stick together when pipes are closely packed may be tested by placing two stripped-off squares of coating in contact under a weight at a given temperature.

The results of practical tests on a number of coatings and photographs of the coated and stripped pipes after removal from the ground are given, together with appendices describing methods of testing and applying coatings and bibliography. A. O.

1419. Cement Coating of Pipe. J. C. Albright. *Oil Weekly*, 4.11.35, **79** (8), 17.—Experiments in the use of cement to reduce external corrosion of pipe lines have been carried out for a number of years, and advancements in cement form design have increased the efficiency and reduced the weight necessary for such equipment.

The latest types of concreting forms are shop-made, constructed of galvanized-iron sheets crimped to give them the necessary rounded shape and ridged to give increased strength. The sheets are U shape, with the upper edge reinforced. A top bar is arranged to lie across the pipe to allow straps to hold the form in place.

Concrete of one part cement to three parts sand is run into the form and tamped around the pipe. L. V. W. C.

1420. Killing Line Vibration. E. Sterrett. *Oil Weekly*, 23.9.35, **79** (2), 29.—Some effective cushioning agent is necessary on main lines if vibration is to be controlled. This agent must be placed as near as possible to the source when plunger pumps are used to force the fluid through the line. Without some sort of shock absorber the liquid in the line takes up the hammer blow of each pumping stroke and transmits it through the line until a point of concentration is reached. At this point failure will occur in time.

The results of tests are given, showing the marked effect on the vibrations transmitted to the line by cutting out the air chamber. When a second chamber was put on the line after the first chamber had been working for about 15 minutes, the smoothness of the curve was noted, giving proof of the effectiveness of this method of cushioning. Unfortunately, absorption of the compressed-air cushion by the oil proceeds at a rate more or less rapid, depending on the gravity of the oil, its temperature and the line pressure.

This absorption is so rapid that weekly recharging of the air bottles has been ordered by some companies.

The danger exists of explosion if correct attention is not given to these air chambers, and the life of the pump valves and seats will undoubtedly be increased by the use of a high-pressure compressor for compressing the air prior to using it in the chamber. L. V. W. C.

1421. Oil Movement by Water Serves as Outlet for South-eastern Louisiana Area. B. Mills. *Oil Weekly*, 4.11.35, **79** (8), 41.—Transportation of all crude produced in the South-eastern Louisiana area is made by barge. No serious difficulty arises from the absence of a main pipe-line outlet, and transportation cost per barrel varies from a few cents to 25 and 30 cents. L. V. W. C.

1422. Heating of Oil Storage Tanks. C. Tiburtius. *Oel u. Kohle*, 1935, **11**, 713.—A method of heating is described which is stated to effect a large saving in the time and steam consumption required for the discharge of fuel oil tanks. The hot oil rising from the steam coils at the bottom of the tank is restricted to a relatively small volume around the outlet pipe by means of a dome structure, and is heated thus in small portions at a time.

Before discharge, the mass of the oil may be stirred by allowing the rising hot oil to spray through a special valve at the top of the dome, instead of passing through the discharge pipe. P. G. H.

1423. Venting of Lease Tanks. E. Sterrett. *Oil Weekly*, 7.10.35, **79** (4), 51.—A fire hazard is often present when a battery of tanks is vented to remove the gas given off by the crude after being passed through the separator. This is especially true in the East Texas fields, where the gas is heavier than air and tends to displace downwards.

This trouble has resulted in the plan of taking the gas under pressure from the separator and using a small stream of it in a jet which was fitted with a riser to the flare.

A venturi tube was made on the riser, and the jet was so placed that the top of it was inside this tube. When gas under pressure from the separator is admitted through the small line and blown through the jet, a partial vacuum is formed below it, and gas is drawn from the tanks so effectively that the elevated vent line may be dispensed with, and the pipe can be lowered to the ground and carried to a point where the flare stack can be advantageously placed. L. V. W. C.

Class 500. Properties and Their Determination.

1424. Natural Gasoline Total Heat Charts. E. G. Ragatz and E. R. McCartney. *Petr. World* (LA), 1935, **32** (9), 43.—Presents a series of total heat charts consisting of seven separate charts covering the individual paraffin hydrocarbon range from methane through normal pentane, together with two residue charts for 60° and 80° A.P.I.

fractions, the residue charts being designed to cover the range of fractions normally left behind in a fractional analysis column after the lighter paraffin hydrocarbon content of a natural gasoline sample has been distilled overhead. Construction and application of the charts are described. The authors have proved the charts to be of considerable value in the handling of various engineering calculations involving light hydrocarbon fractions. W. W.

1425. Wide Range Boiling-point Conversion Chart for Hydrocarbons and Petroleum Products. E. S. L. Beale and P. Docksey. *J.I.P.T.*, 1935, **21**, 860–870.—An account of experiments on the determination of the vapour pressures of narrow cut fractions of Iranian crude and of dodecane up to high temperatures, together with a nomograph constructed from the results obtained and covering the pressure range 0·01–760 mm. mercury. G. R. N.

1426. Trend of Volatility of Motor Fuels. G. G. Oberfell, R. C. Alden and H. M. Trimble. *Proc. 14th Ann. Conv. Nat. Gasoline Assn. of America*, May 1–3, 1935, 23.—With regard to the relationship between vapour pressure and volatility (distillation test), it is pointed out that two gasolines can have the same vapour pressure (Reid) and yet have widely different distillation tests. The lower the 10% distillation temperature, the easier the starting, but the vapour pressure increases, and hence good fractionation of the light ends of gasoline is necessary. The middle portion of the distillation test affects the warming-up period and acceleration of engines, a low middle distillation temperature giving a short time of use of the choke and faster acceleration. More power is developed with a low 90%-distilled temperature. A review of the period 1929–1935 shows that the volatility of motor fuels has increased irrespective of grade, with good control of Reid vapour pressure in the summer quarters. In all changes, departure from the average volatility in both directions has been uniform. Of the four features examined (Reid vapour pressure and 10, 50 and 90% distillation temperatures) the 50 and 90% temperatures have shown the greatest increases in volatility. W. H. T.

1427. Potential Value of Volatility in Motor Fuels. G. G. Brown. *Proc. 14th Ann. Conv. Nat. Gasoline Assn. of America*, May 1–3, 1935.—An account is given of an investigation carried out for the Nat. Gasoline Assn. with a view to determining (1) the advantages of the use of fuels of high volatility and (2) what changes in engines would be required in order to obtain full benefit of the potential value inherent in fuels of high volatility. A Chevrolet car was used on a level stretch of road 1 mile in length, tests being made in both directions at constant speed except for acceleration measurements. The data obtained included fuel consumption, wind velocity, atmospheric temperature, acceleration and maximum speed, the latter two giving all the necessary information required to determine performance. Maximum speed was taken as a measure of maximum power and mileage. The fuels used were :—

	1.	2.	3.
10% evaporated . . .	117° F.	137° F.	151° F.
50% ,, . . .	138° F.	198° F.	260° F.
90% ,, . . .	201° F.	290° F.	382° F.
Octane number . . .	65·2	63·9	63·2
Reid vapour pressure . .	10·15	7·15	7·05

The fuels were chosen to have substantially the same octane number, so that any differences in the results of the tests would be due to differences in the volatility of the fuels. With ignition set to obtain incipient detonation, the car rated fuel 3 six octane numbers higher than fuels 1 or 2. Acceleration was improved by the use of the fuel of high volatility, but consumption increased somewhat at lower speeds, and was the same for high and low volatility fuels. In cold weather the best mileage was obtained with the least volatile fuel, but for equal performance superior mileage was gained by the use of the most volatile fuel. In warm weather the best performance was obtained with factory adjustment at 60° F., only when the most volatile fuel was used. A gain of 15–20% in top speed and acceleration could be obtained by the use of fuel 1 if manifolding and cooling were modified to take full advantage of this type of fuel. In the critical region of acceleration, 7 volatility numbers were found to be equal in effect to 10 octane numbers. W. H. T.

1428. Characterization of Tars and Bitumen by Means of Viscosity–Temperature Curves. L. Ubbelohde, C. Ulrich and C. Walther. *Oel u. Kohle*, 1935, **11**, 684–690.—The measurement of viscosity at a standard temperature (DIN 1995/96) is insufficient for the evaluation of tars and bitumen for road-building purposes. Measurements in an upward-flow capillary viscometer showed that the viscosity–temperature function was the same as for lubricating oils. The Walther empirical formula: $W = W_1 + m(\log T_1 - \log T)$, where $W = \log\log(\nu + 0{\cdot}8)$, ν = kinematic viscosity in centistokes, m = constant was applicable; by plotting log viscosity against temperature on logarithmic graph paper, straight lines were obtained, the slopes of which were the same for materials of similar origin. The slope is defined by m, the following values of which are given: pitch, 5·3–5·6; tars, 5·1–5·4; asphaltic bitumen, 3·6–3·9.

The Ubbelohde dropping points, when plotted on the viscosity–temperature curves, fall on a straight line, representing a constant viscosity (250,000 cst.). The Kramer and Sarnow softening point, on the other hand, does not occur at the same viscosity in all cases; the higher the K. and S. value, the higher is the viscosity at that temperature.

It is shown that reliable viscosity figures may be obtained with the usual Road Tar Viscometer at a temperature 15° C. above the dropping point; the time of outflow × 340 gives viscosity in centistokes. P. G. H.

1429. Ignition of Gases. Part IX. Ignition by a Heated Surface. Mixtures of Methane and Air at Reduced Pressures. C. A. Naylor and R. V. Wheeler. *J.C.S.*, 1935, 1426–1430.—The authors conclude that the ignition of mixtures of methane with oxygen and nitrogen is a thermal reaction catalysed by the products of an initial slow and flameless combustion. The reactions are not isothermal. Working with methane contents of 6–12%, the ignition temperature increased with methane content, whilst with a given methane content the pressure determined the temperature of ignition.

Semenov's relationship between pressure and ignition temperature did not apply to the results obtained with mixtures containing more than 10·7% of methane. Results given include lags in ignition for a pressure range of 342–760 mm. with methane contents of from 6 to 12%. The authors advance a tentative explanation based on change in the type of reaction involved, *i.e.* from surface to gas phase, and on the rate at which certain mixtures become non-inflammable as a result of pre-flame combustion. W. E. J. B.

1430. Effectiveness of Lead in Pure Hydrocarbons. Anon. *Nat. Petr. News*, 31.7.35, **27** (31), 23.—An investigation has shown that tetra-ethyl lead is much more efficient in retarding detonation in certain pure hydrocarbons than in standard motor fuels. Dope was added at the usual rate of 1 ml. per gallon, and in standard fuel an increase in the critical compression ratio of 0·1–0·3 was obtained. With certain aromatic paraffin and naphthene hydrocarbons the gain amounted to 1–3 ratios. With olefins and acetylenes the effectiveness of lead shows little variation irrespective of the critical compression ratios. With unsaturated cyclic hydrocarbons the dope functioned as a detonation promoter. Data obtained indicate that, in general, lead is more effective in those compounds which have a double bond removed from the end of the molecule and that lead is most effective at low concentrations. H. G.

1431. Disulphides Decrease Susceptibility of Motor Fuel to Lead. W. A. Schulze and A. E. Buell. *Nat. Petr. News*, 9.10.35, **27** (41), 35.—The presence of sulphur bodies in a gasoline decreases not only the octane number, but also its "lead response." Moreover, the state of combination of the sulphur is of great importance in determining the extent of these effects. Cyclic sulphur compounds have the least effect, whilst the alkyl disulphides produced the greatest effect. For instance, the addition of 1 c.c. of T.E.L. per gallon of reference fuel increased the octane rating by 12·5, whilst the addition of 0·41% wt. S as ethyl disulphide to the leaded fuel reduced the gain in octane rating to 4. In general, with aliphatic sulphur bodies the deleterious effect of their presence in the fuel increased with the size of the alkyl radicle, and with bodies of the same molecular weight branched radicles have a greater effect than straight-chain radicles. The mechanism of the effect is not known, but it is suggested that the effect of the state of combination of the S is a function of heat stability of the sulphur body, *i.e.* the greater the heat stability the smaller is the deleterious effect.

It is demonstrated that the removal of existing sulphur bodies in a gasoline increases both initial octane number and the lead response. In this case, however, the greatest effect is seen when the last traces are removed. H. G.

1432. Explosion of Mixtures of Combustible Gases with Air, by Nuclear Drops of Water and other Nuclei and by X-Rays. R. O. King and G. Mole. *J.I.P.T.*, 1935, **21**, 838–859.—Parts V–VII of the Air Ministry Official Report. Part V deals with the experimental conditions required for the ignition of hydrogen–air mixtures by nuclei; Part VI deals with the nuclear drop ignition temperatures of ethylene–air mixtures passing through a silica combustion tube; the relation between wall and gas temperature and the effect on ignition temperatures of the central thermocouple sheath, and Part VII deals with the effect of a variety of nuclei, mainly mineral dusts, to ignite and explode a mixture of hydrogen and air; the exceptional efficacy of Ni_2O_3 dust to ignite mixtures of air with hydrogen, ethylene or methane. G. R. N.

1433. Heats of Vaporization of Eight Gasolines. R. S. Jessup. *Bur. Stand. J. Res.*, 1935, **15**, 227–236.—The heats of vaporization at 40° C. of eight gasolines were measured to an estimated accuracy of about 3% in connection with the analysis of engine performance, and also in connection with the problem of ice formation in the carburettors of automobile and aircraft engines. The method used consisted essentially in vaporizing a known mass of fuel in a stream of air flowing through a coil of tubing immersed in the water of a calorimeter, the change in temperature of which was accurately measured.

The fuels investigated comprised one natural gasoline, two aviation gasolines, one straight-run and three cracked naphthas and one "safety fuel." This latter was a hydrogenated product, and a survey of its characteristics indicated that it was richer in aromatics than the seven other gasolines.

It was found that with the exception of the "safety fuel" the heats of vaporization could be represented within the accuracy of the measurements by a linear function of either the specific gravity or average volatility.

The differences in the heats of vaporization of the various fuels were by no means great, and it is considered that the appreciable variation in their tendency to form ice in the carburettor must be due largely to differences in the completeness of vaporization resulting from differences in volatility. D. L. S.

1434. New Apparatus for the Exact Estimation of the Naphthalene Content of Motor Benzole. W. Zwieg and F. Kossendey. *Petr. Zeit.*, 16.10.35, **31** (41); *Motorenbetrieb.*, **8** (10), 5–6.—The determination described is based on the fact that naphthalene is absorbed by picric acid on strong cooling preferably in a Dewar flask. A molecular compound of naphthalene and picric acid is formed. A weighed quantity of benzole is shaken with cold picric acid solution, and air is passed through the solution. The majority of the naphthalene is absorbed by the acid, and on cooling in a Dewar flask the whole of the naphthalene becomes absorbed. The benzole is removed by evaporation. W. S. E. C.

1435. Detector for Low Concentrations of Hydrogen Sulphide. J. B. Littlefield, W. P. Yant and L. B. Berger. *Petr. World*, 1935, **32**, 202–205.—Describes a hydrogen sulphide detector based on a colour-change reaction on the surface of sensitized granules placed in a glass tube through which atmosphere to be examined is aspirated by means of a rubber bulb or hand pump. The amount of H_2S is indicated either by the distance the colour change travels in the column of granules for a constant sample volume, or the volume of sample required to produce a standard length of travel. Methods for preparing the tubes and the results of tests are given. The detector is designed primarily for making field or plant examinations of the air breathed by persons. W. W.

1436. Naphthalene and β-Methylnaphthalene from Rumanian Crude Oil. T. Cosciug. *Petr. Zeit.*, 16.10.35, **31** (41), 1–7.—The petroleum investigated was that obtained from a depth of 1017·5 m. of well number 4 Dorf Gura Ocnitzei, Bezirk Dambovitza. The fraction boiling between 30° and 200° C. was fractionated under 20 mm. mercury pressure into 2° cuts and then treated with picric acid.

The fraction boiling between 100° and 102° C. on treatment with a concentrated ethereal solution of picric acid and cooling gave crystals of naphthalene which were

crystallized from alcohol. Similar results were obtained with the fraction boiling between 102° and 104° C.

On fractional crystallization of the picrates obtained from the 110–112° fraction, it was observed that two methylnaphthalenes were formed, *i.e.* isomeric α- and β-methylnaphthalenes, and as much as 8% of the β isomer or of both isomers was obtained.

W. S. E. C.

1437. Separation of Petroleum Hydrocarbons with Silica Gel. B. J. Mair and J. D. White. *Bur. Stand. J. Res.*, 1935, **15**, 51–62.—Experiments have been carried out on the separation of binary mixtures of hydrocarbons of different types and molecular weights by filtration through silica gel.

The apparatus consisted of an adsorption tube 40 cm. long, at the top of which was sealed a bulb to act as a reservoir for the liquid to be filtered. The experiments were carried out under an air pressure of 4 lb./sq. in.

The results of the tests carried out showed that: (*a*) The gel would completely remove aromatic and olefin hydrocarbons from paraffins and naphthenes. In the case of the one olefin investigated the adsorptive capacity of the gel was only one-third of its adsorptive capacity for aromatics; (*b*) The capacity of silica gel as an adsorbent for aromatics depended on the concentration of the solution, and also to some extent on the components of the solution from which the aromatic hydrocarbon was being adsorbed; (*c*) The gel showed a slight tendency to adsorb naphthenes in preference to paraffin hydrocarbons; (*d*) A slight separation of *n*-paraffins of different mol. wt. occurred, the hydrocarbon with low mol. wt. being preferentially adsorbed; (*e*) The silica gel showed no tendency to crack or attack aromatic, naphthenic or paraffinic hydrocarbons.

Separation of hydrocarbons in these experiments was indicated by determining the refractive indices of the mixture and components.

The gel could be reactivated after experiments, and was then practically as good as the unused material.

A simple laboratory method for the complete removal of aromatics from naphthene or paraffin hydrocarbons with a 98% recovery has been worked out. It is useful for investigating the composition of distillates containing less than 15% aromatics. If the aromatic content is higher than this, a preliminary extraction with SO_2 is recommended.

D. L. S.

1438. Separation of a Dimethyl*cyclo*hexane Fraction from a Mid-Continent Petroleum. R. T. Leslie. *Bur. Stand. J. Res.*, 1935, **15**, 41–50.—The determination of the naphthene content of petroleum is of interest because of the part these compounds play in the knocking characteristics of gasolines and the lubricating properties of the higher-boiling fractions.

From a fraction 100–129° C. of a Mid-Continent oil, toluene, 2-methylheptane and *n*-octane were removed as described in previous papers. The refractive index/boiling-point curve indicated the probable presence of naphthenes between 120° and 123° C. A cut boiling near 120·5° C. was fractionated by dissolving in propane and pouring the solution into methane. This was followed by distillation and further recrystallization, when a practically constant-boiling and constant-freezing material with an empirical formula of a monocyclic naphthene was isolated.

In an attempt to identify this hydrocarbon, pure *m*- and *p*-xylenes were hydrogenated, and the resulting mixtures partly separated by fractional crystallization. Evidence was forthcoming that the petroleum naphthene was probably chiefly *m*-dimethyl*cyclo*hexane. Its infra-red spectrogram was very similar to the spectrograms of both hydrogenated *m*- and *p*-xylenes.

Photomicrographs showed the presence in the petroleum product of at least two crystalline forms, one melting at a higher temperature than the other. This was also indicated by the cooling curves obtained. It is possible that this material is a eutectic of isomers with a slight excess of one.

It is estimated that the original crude contained not less than 0·15% by volume of this naphthene.

D. L. S.

1439. Isolation of Ethyl*cyclo*hexane from a Mid-Continent Petroleum. F. W. Rose, Jr., and J. D. White. *Bur. Stand. J. Res.*, 1935, **15**, 151–161.—The naphtha fraction of the crude after successive distillations followed by treatment with liquid SO_2 yielded a cut boiling principally at 131·8° C. This was crystallized by dissolving in propane and

pouring into methane, and further purification effected by filtration through silica gel and distillation with glacial acetic acid. The material was finally recrystallized and its properties indicated it to be ethyl*cyclo*hexane.

Owing to the discrepancies in the physical constants of this hydrocarbon as reported in literature, a quantity was synthesized by hydrogenating ethylbenzene. The synthetic product was suitably purified and compared with the petroleum product with respect to the following physical properties: b. pt., f. pt., refractive index, density, molecular weight and infra-red absorption spectrum. The C.S.T. in aniline and the carbon–hydrogen ratio of the petroleum hydrocarbon were also determined. It was estimated that the purity of the ethyl*cyclo*hexane from petroleum was about 95 mole-% and that the crude contains no more than 0·1% of this hydrocarbon.

D. L. S.

1440. Present Status of the Isolation and Identification of the Volatile Hydrocarbons in a Mid-Continent Petroleum. R. T. Leslie and J. D. White. *Bur. Stand. J. Res.*, 1935, **15**, 211–225.—The results to date of the American Petroleum Institute's Research Project No. 6 dealing with the chemical constitution of the fraction of a Mid-Continent petroleum boiling between 55° C. and 180° C. are summarized.

To make the work as complete as possible, a history of the crude from the well to the laboratory has been kept.

A cut 55–145° C. was obtained by fractionation, and was then separated into close boiling fractions by further distillation. From these fractions a number of hydrocarbons were separated by various means, and the remaining material was repeatedly distilled to give a new set of fractions from which further hydrocarbons were separated. Altogether in this cut estimates have been made of the percentage contents of the twenty-two hydrocarbons isolated, the six detected and in process of separation and the nineteen the presence of which in significant amounts is suspected. These quantities have been represented graphically in relation to the curves showing the distribution with temperature of the volume and the refractive index of the distillate.

It is probable that these forty-seven hydrocarbons account for practically all the material in this fraction giving, on this assumption, a ratio of 6 : 3 : 1 for the paraffins, naphthenes and aromatics.

Up to the present only five hydrocarbons have been isolated from the material boiling from 145 to 180° C., these comprising 32% of the fraction. They consist of two normal paraffins (28%) and three aromatic hydrocarbons (4%). D. L. S.

1441. Gum Deposits in Gas Distribution Systems. C. W. Jordan, A. L. Ward and W. H. Fulweiler. *Ind. Eng. Chem.*, 1935, **27**, 1180.—In previous communications dealing with this subject, it was shown that vapour-phase gum is formed as the result of the action of oxides of nitrogen on the unsaturated compounds normally present in manufactured gas. The oxides of nitrogen, usually present as nitric oxide, were found to oxidize slowly to peroxides, which in turn reacted rapidly to form gum. This, the final section of the work, deals with processes which have been developed or suggested for the removal of oxides of nitrogen, and hence to eliminate vapour-phase gum. It is shown that any process involving solution or absorption is inadequate, and that the requirements of a perfect reagent are rapid and quantitative reaction to form a stable substance with a vapour pressure of zero. The reagent should not react with carbon dioxide or monoxide or with hydrocarbons; it should be unaffected by water, and not reduced by hydrogen nor oxidized by oxygen or poisoned by sulphur or cyanogen compounds. The most suitable reagent was found to be a mixture of iron sulphide and sulphided sodium carbonate, for with the correct ratio of iron and soda, absorption may reach 95% of the theoretical. W. H. T.

1442. Aromatization by Catalysis of Fractions of Baku Gasoline. N. D. Zelinsky and N. I. Shuykin. *Ind. Eng. Chem.*, 1935, **27**, 1209.—Fractions of Surakhany gasoline (b. pt. 75–105° C. and 105–125° C.) containing high percentages of hydroaromatic compounds have been subjected to catalytic dehydrogenation to give condensates containing 53% by volume of aromatic hydrocarbons. This was effected by a single passage of the gasoline vapours at 300° C. in a weak current of hydrogen over a catalyst comprising nickel deposited on alumina. The catalyst was reactivated by treatment with dry air at 250° C. for 2 hours, followed by reduction at 350° C., but its activity decreased somewhat after each regeneration. The behaviour and composition of four other fractions (118–120° C., 120–124° C., 124–130° C., and 130–140° C.) were next

investigated by means of catalytic dehydrogenation, the catalyst in this case being platinum deposited on activated charcoal. After two consecutive passages over the catalyst at 300° C., almost complete dehydrogenation took place. Both catalysts brought about refining of the gasoline with complete elimination of traces of sulphur present in the original fractions. During the work it was shown that the sulphuric acid and the aniline point methods for the estimation of aromatics gave, within experimental error, results of close similarity. W. H. T.

1443. Syntheses from Natural Gas Hydrocarbons. H. B. Haas, E. T. McBee and P. Weber. *Ind. Eng. Chem.*, 1935, **27**, 1190.—It is shown that, provided pyrolysis temperatures are avoided, there appears to be no evidence of a carbon-skeleton rearrangement (as suggested by previous workers) during thermal or photochemical chlorination of natural gas hydrocarbons. In every case examined, all the theoretically possible isomeric monochlorides obtainable without rearrangement were found. It is claimed that early views regarding carbon-skeleton rearrangement were affected by inaccuracies in the published physical constants of the monochlorides. The author's data were obtained by synthesizing the pure alcohols using the Grignard reaction and treating the alcohols with hydrochloric acid. The substantial absence of rearrangement was shown by reconverting the chlorides to the original alcohols via Grignard reagents, followed by oxygenation and hydrolysis, and also by conversion into the anilidenes. The chlorides were treated with concentrated sulphuric acid in order to eliminate the possibility of the presence of olefines or chlorolefines. The presence of these materials is considered as largely responsible for previous inaccuracies in physical data regarding the monochlorides. In the case of propane, no carbon-skeleton rearrangement is possible. Descriptions and diagrams of the chlorination apparatus are given. W. H. T.

1444. Swedish Govt. Army Lubricating Oil Specifications. Anon. *Industrial Standardization*, 1935, **6**, 222.—The Swedish Government has adopted the following specifications for oil for army cars, based partly on U.S. 1932 Federal Specifications and partly on data from oils on the Swedish market :—

Oil.	M. 1.	M. 2.	M. 3.	M. 4.	M. 5.
Sp. Gr. (Max.)	0·925	0·930	0·930	0·930	0·935
Kinem. Visc. at 250° C.	30–45	55–70	80–95	105–125	135–170
,, ,, at 100° C. (min.)	6	8·5	11	14	18
Fl. Pt. (P.M.)° C. (min.)	170	180	190	200	200
Cold Test (° C.)	— 20	— 10	— 10	0	0
Conradson Carbon Test (% (max.))	0·3	0·7	0·8	1·0	1·5
Oxidation by Sligh Test (max.)	20	20	15	15	10

C. L. G.

1445. Methods for Testing Lubricating Oils. C. W. Woolgar. *Oil & Gas J.*, 19.9.35, **34** (18), 34.—The final criterion of a lubricating oil is its performance under service conditions, its ability to reduce friction and prevent seizure of the bearing surfaces under widely varying conditions of temperature, pressure and rubbing velocity for as long a period as possible without deterioration. The essential lubricating properties of an oil can be judged only from the results of a mechanical test. The modern theory of friction admits of three types, viz. dry, boundary and fluid film. Under conditions of boundary lubrication the bearing surfaces are separated by a thin film of molecular dimensions adsorbed at the surface. The friction is due to the force necessary to shear the molecular layers of the third substance, and to overcome any residual molecular attraction of the two bearing substances. Friction is thus dependent on the "oiliness" of the oil, or tendency towards the adsorption and adhesion to a metallic surface shown by a lubricant used under boundary conditions.

A variety of early machines which were designed to determine the "oiliness" of lubricants are briefly described and their defects are pointed out. It is extremely doubtful whether the "durability" of an oil as measured by the early methods of test bears any relation to its behaviour under working conditions. Since 1930 a number of machines for determining the efficiency of extreme pressure lubricants have been designed. Descriptions and criticisms of a number of such machines, including the Timken, Larson, Almen, Boerlage, Phelps, S.A.E. and Jakeman testers, are given.

A great deal of confusion exists regarding the value of adding "oiliness" materials to crankcase lubricants in service, and the relation between results obtained by test machines and those obtained under service conditions.

It is suggested that a useful line of research would be to find operating conditions for the various testing machines used suitable for each particular type of oil, the conditions being made as near as possible to those encountered in service. It would probably be found then that any machine would grade a series of the same general class in the same order of merit, but it is not likely that, if all types of lubricants are mechanically tested under the same specific conditions, the machine will give useful information about all of them. It is considered that a greater advance would be made by applying fundamental physical laws and theories to the problem, rather than attempt to correlate with service conditions such empirical tests as those mentioned above. R. A. E.

1446. Physical Properties and Chemical Constitution of Lubricating Oils. M. Freund. *Refiner*, 1935, **14**, 486–489.—For normal refined petroleum lubricating oils of similar viscosity at 50° C., the specific gravity appears to be characteristic, and indicates the average chemical composition of the oil, as well as those properties directly dependent on composition.

The average boiling point, aniline point, apparent molecular weight, and hydrogen content decrease directly with an increase in the specific gravity; at the same time, there is a simultaneous increase in the slope of the viscosity–temperature curve, the carbon content generally diminishes, whilst the content of aromatic or reactive hydrocarbons increases. B. C. A.

1447. Improved Film Strength of Motor Oils. C. O. Willson. *Oil & Gas J.*, 19.9.35, **34** (18), 43.—The Atlantic Company have recently installed a nitrobenzene extraction plant for refining lubricating oils, thus obtaining improvements in general specification properties. A chemical compound is also used to increase the film strength of the oils. A demonstration was staged to show the improvement obtained by this compound. In an Almen tester a variety of branded oils of varying viscosity, but without chemical additive, were tested. Seizure took place when weights representing 2000–6000 lb./sq. in. were used. The average for thirty-four leading brands was 4945 lb./sq. in., whereas the Atlantic oils withstood pressures equivalent to 15,000 lb./sq. in. without seizure. Results of bench-wear tests carried out on six 80-h.p. 6-cyl. engines run for periods equivalent to 15,000 miles on S.A.E. 20 oils were also reported. Three of the engines were run on oils containing the additive and three on regular oils. The engines were chilled to 20° F. by circulating cold Prestone for 1 hr., started and run for 1 hr. at 3000 r.p.m. under load with open throttle, cooled naturally for 2 hrs. and the cycle repeated. In addition a 6-hour run was inserted every 24 hrs. All moving parts except bearing shells were carefully measured before and after test. Cylinder wear ($\frac{1}{4}$ in. from the top) and ring gap increases for the two types of oil are tabulated. With the oils containing additive, the average cylinder wear was reduced by 33·3% and the average ring gap increase by 40%. R. A. E.

1448. Characteristics of Diesel Fuel Oil. W. F. Joachim. *Gas & Oil Power*, 10.10.35, 31.—The objects of the work were to determine: (*a*) what fuel qualities influence engine performance under normal operating conditions; (*b*) the range of influence of these fuel qualities in normal fuels; (*c*) recommendations for suitable fuel specification for various diesel engines and services. The engines used were a 50-k.w. Cooper-Bessemer type E.P.—3 marine diesel engine generating set and the C.F.R. diesel engine unit with both the original open-type and the new Comet cylinder heads. The conditions under which the engines were run are specified. The Cooper–Bessemer engine was provided with an exhaust smoke density meter and a Maihak indicator fitted with a pressure-time drum. A Bosch nozzle tester was used to determine the spraying action of each fuel nozzle before and after each 24-hr. fuel performance run, and the nozzle carbon deposits were photographed. Combined with inspection of the nozzle this gave useful information on important considerations. Critical compression ratios and cetene values of the fuels used were determined in the C.F.R. engine with both types of cylinder head, and correlated with data from the indicator diagrams of the Cooper–Bessemer engine. Explosion pressure rise and fuel consumption of the fuels under loads ranging from 0 to 120% are plotted against b.m.e.p. for the Cooper-

Bessemer engine. The explosion pressure rise, burning rate in lb. per sq. in. per crank angle degree, and the measured knock (Explosion pressure rise × burning rate × 10^{-4}) at 100% load were then plotted against critical compression ratios and cetene values obtained in the C.F.R. engine. The fuels tested comprised straight-run and cracked distillates and residues and blends of these basic fuels in varying proportions. The conclusions reached as a result of the work are: (1) Complete fuel performance tests of fuels in commercial diesel engines are necessary to determine fuel ignition, combustion rate, power, economy, gumming, carbonization, lubricating oil contamination and wear characteristics; cetene number determinations alone are insufficient; (2) the fuel properties to be specified, the recommended control and the operating factors they affect, are: (*a*) ignition quality—cetene number—ease of starting, degree of combustion knock, roughness of engine operation and to a smaller extent fuel consumptions and exhaust gas temperatures; (*b*) sp. gr.—A.P.I. gravity—fuel consumptions, and to a lesser extent exhaust gas temperatures; (*c*) volatility—90% temperature A.S.T.M. distillation—fuel consumptions and exhaust temperatures; (*d*) combustion residue—similar to A.S.T.M. method, except that after ignition of oil vapours, all external heat be removed, the oil being burned to a residue by its own flame only—nozzle tip carbon; (*e*) viscosity—S.U. at 100° F.—lubrication of injection system parts and leakage; (*f*) flash point—P.M. closed—no influence but must be within legal limits; (*g*) pour point—A.S.T.M. method—controls possibility of fuel handling and pumping at existing temperatures; (*h*) water and sediment—A.S.T.M. centrifuge method—injection system corrosion, abrasion and clogging; (*i*) sulphur—chemical analysis—certain forms influence injection system and sometimes engine corrosion and wear; (*j*) ash—A.S.T.M. method—influences wear; (*k*) gum—to be developed—gumming tendencies may cause sticky or stuck fuel-nozzle valves. Gum formation probably results from very small percentages of unstable products in certain fuels, and may be initiated and accelerated by excessively hot fuel nozzles; (3) the recommendation of suitable fuel specifications for certain types of diesel engines and services is possible as a result of the present work. R. A. E.

1449. Cyclic Constituents of Petroleum Ceresin. J. Müller and S. Pilat. *J.I.P.T.*, 1935, **21**, 887–894.—An account of experiments on the separation of paraffin and ceresin from ozokerite and crude oil and on the examination of these products to ascertain their structure and composition. G. R. N.

Class 600. Refining and Refineries.

1450. Coking of Petroleum Residues. D. G. Jones. *J.I.P.T.*, 1935, **21**, 895–906.—A paper outlining a novel method of coking petroleum residues and its application to a heavy residue, together with an account of the experimental work entailed. G. R. N.

1451. Billingham Hydrogenation Plant. Anon. *Petr. Times*, 19.10.35, **34**, 407.—An account is given of the official inauguration of the plant, together with an illustrated description of the principal features of the process. H. G.

1452. Thermal Polymerization of Gaseous Hydrocarbons. Anon. *Refiner*, 1935, **14**, 480–482.—The Polymerization Process Corporation offers a non-catalytic process for thermal polymerization of gaseous hydrocarbons, both saturated and unsaturated. The operating conditions are a function of the charging stock composition, but are usually limited to 1000–3000 lb. pressure and temperatures from 950° to 1100° F.

A suitable charging stock may consist of hydrocarbon gases of two carbon atoms or more, the charge gases being freed by fractionation from hydrogen, methane, plus a certain proportion of difficultly recoverable ethane. The higher molecular weight gases, including recycle gas, are charged to the polymerizer, the discharge from which, in combination with the fresh feed, is fractionated under pressure. The hydrogen and methane are removed as fuel gas, the recycle is returned to the polymerizer, and the gasoline distilled to end point.

A typical inspection of a 400° F. end-point polymer gasoline shows 20% over at 140° F., 80–86% insoluble in acid, and octane blending value of 80 to more than 100. B. C. A.

1453. Velocity of Absorption of Propylene by Sulphuric Acid. V. Pigulevskii and N. Rudakova. *Goskhimtekh*, 1933, **1**, 66–77.—The following conclusions are based on described experiments: (1) the absorption of propylene with H_2SO_4 is a monomolecular reaction; (2) the amount of propylene absorbed by the unit of surface in a unit of time is proportional to the partial pressure of propylene, and does not depend on its volume; (3) the constant for the velocity of the reaction is independent of the size of the apparatus; (4) the absorption of the propylene with H_2SO_4 is an autocatalytic action; (5) the constants for the velocities of reaction of the H_2SO_4 at 15° C. were determined for acids of 75–88%; (6) the relationship of the velocity constant for an 88% acid was determined from 5° to 25° C.; (7) the relationship of the reaction velocity constant of an 88% acid and the amount of saturation was determined. For. Petr. Techn.

1454. Elimination of the Corrosive Properties of Cracked Gasoline. L. Sel'skii. *Grozn. Neft.*, 1934, **4** (8), 45–49.—The corrosion of distilling apparatus was eliminated by introducing a NaOH solution into the pipe-line used for the pressure distillate, the caustic being recycled until the gasoline again showed corrosive properties. It was found that a gasoline which received a preliminary caustic treatment did not corrode the apparatus after a H_2SO_4 treatment followed by redistillation, whilst a gasoline treated with H_2SO_4, followed by washing and alkali treatment, was corrosive even though the original gasoline was not. The use of a solution of calcium hydroxide on a refinery scale is accompanied by the formation of emulsions, whilst satisfactory results could not be attained with ammonia. For. Petr. Techn.

1455. Avoidance of Physical Contact with Lube Solvents. Anon. *Nat. Petr. News*, 18.9.35, **27** (38), 40.—Comprehensive rules and suggestions are given for the safeguarding of the welfare of the personnel of solvent extraction plants. Particular reference is made to chlorinated hydrocarbons. H. G.

1456. Liquefied Gas Plant. R. C. Conine. *Oil & Gas J.*, 12.9.35, **34** (17), 40.—A casing-head gas extraction plant has recently been installed at Lucinda, Pa., with a capacity of 800,000 cu. ft. of gas per 24 hrs. producing 800 gall. propane and 1200 gall. natural gasoline. The gas is pulled from the wells under a 26-in. vacuum into a receiver and compressed by stages to 5 in. vacuum, 48 lb., 289 lb. and finally 600 lb. when a propane cut is being taken or 1200 lb. for a butane cut. From the final receiver the gas goes to silica gel dehydrators, and thence to two fractionating towers. The temperatures at the bottom of the two towers are maintained at 222° F. and 280° F. respectively, and the reflux temperatures at the top of the towers at — 45° F. and 50° F. When propane is taken out, the pressure in the second fractionator falls from 600 to 225 lb., and when butane is cut, from 1200 to 350 lb. Gases not condensed in the first fractionation are withdrawn for fuel. The reflux temperature of the first fractionator is maintained by a propane refrigeration system. C. L. G.

1457. Applications of Adsorptive Carbons. H. Griffiths. *Petr. Times*, 31.8.35, **34**, 231.—The article deals with the use of activated carbon in both liquid-phase and vapour-phase adsorption processes. Since, in general, the adsorbed material is 100% recovered by the simple passage of steam at 100° C., the process is extremely economical. The extraction of gasoline and benzole are dealt with in particular. In the recovery of benzole from town gas the problem is somewhat complicated by the presence of thio bodies, naphthalene, etc. H_2S must be removed before the gas is passed to the carbon adsorbers. Bodies such as naphthalene which are absorbed with the benzole are retained by the carbon after the "desorbing" process. The carbon therefore has a limited life in this case. Nevertheless, the process is claimed to be worth while because of its simplicity and the improved quality of the benzole extracted. H. G.

1458. Cupric Chloride for Sweetening Refinery and Natural Gasolines. W. A. Schulze and A. E. Buell. *Oil & Gas J.*, 17.10.35, **34** (22), 42.—Certain solutions of copper salts, those containing relatively high concentrations of chloride or bromide, oxidize all the mercaptans present in a gasoline to disulphides. As an example the mechanism of the reaction with cupric chloride is:

$$4R-S-H + 2CuCl_2 \rightarrow R-S-S-R + 2R-S-Cu + 4HCl \quad (1)$$

$$2R-S-Cu + 2CuCl_2 \rightarrow R-S-S-R + 4CuCl \quad . \quad . \quad . \quad (2)$$

The cuprous chloride, although practically insoluble in water, is quite soluble in solutions containing a high concentration of chloride salts. The cuprous chloride and the hydrochloric acid formed as above can be oxidized by air to regenerate cupric chloride :—

$$4CuCl + 4HCl + O_2 \rightarrow 4CuCl_2 + 2H_2O \quad . \quad . \quad . \quad (3)$$

It has been found that rather low concentrations of cupric copper are adequate, so that in commercial application the sweetening reagent solution can be prepared from copper sulphate and sodium chloride. Since the amount of air required is small, regeneration can be effected by dissolving air in the gasoline prior to treatment. In early work it was noticed that certain cracked gasolines, after treatment, tended to discolour progressively, but this can be prevented by contacting with sodium sulphide solution immediately after sweetening. It is necessary to remove the H_2S from the raw product prior to treatment and to remove free sulphur either before or after treatment to give a good corrosion test. Both H_2S and free sulphur may be removed by contacting with aqueous solutions of alkaline polysulphide, as defined in a patent soon to issue.

The cupric chloride treatment may be applied by two methods : (*a*) Wet treatment, in which the sour gasoline, free of H_2S, is contacted with treating solution in a continuous manner, and the solution either simultaneously or subsequently regenerated by air. This method necessitates the use of corrosion-resisting equipment, either cypress wood or steel tanks lined with anti-corrosive metal. One plant using this method for four years has successfully treated 5000–10,000 brl. a day of gasolines containing up to 0·05% mercaptan sulphur. The only chemical cost is that due to mechanical loss of the treating solution. (*b*) Solid method, in which the reagent is prepared by impregnation of adsorbents such as Fuller's earth with the copper solutions. The sour gasoline is contacted with the reagent by filtration. The filter bed is formed by supporting the reagent on a layer of mineral wool inside a steel filter tank protected from corrosion by a coat of resinous varnish. Continuous regeneration by solution of a predetermined amount of air in the gasoline is used. High rates of flow are obtained. One plant has used this method successfully for six months treating a natural gasoline of very high mercaptan content. The cost of chemicals and labour per 1000 gallons has been 5 cents, as compared with 135 cents when hypochlorite treatment was used.

Advantages claimed for cupric chloride treatment as compared with other sweetening methods are : (1) Saving in chemical costs ; (2) no loss of gasoline during treatment ; (3) no loss in octane number of gasoline ; (4) retention of natural gum inhibitors in the gasoline ; (5) improved stability of treated gasoline ; (6) decreased operating costs ; (7) low investment cost. R. A. E.

1459. Synthesis of Benzine from Water Gas. F. Fischer. *Oel u. Kohle*, 1935, **11**, 782–785.—A description of the " Kogasin " process as operated by Ruhrchemie A.-G. Advantages over synthetical methods, such as that of Bergius for coal hydrogenation, are the low temperatures (about 200° F.) involved and the use of pressures not greater than 1 atmosphere.

Water gas, produced by any of the known methods, is purified roughly to remove H_2S ; the content of organic sulphur is lowered to below 0·2 gm./100 ml. by contacting with a special catalyst (undisclosed). The synthesis is effected by passing the gas ($CO + H_2$) over a catalyst, the base of which may be cobalt, nickel or iron.

Water and an oily product, a quoted example of which consisted of two-thirds benzine and one-quarter kerosine and diesel oil, are produced. It is stated that 72% of the theoretical yield had been obtained by the use of a cobalt-base catalyst, and that a plant now in operation is capable of producing 1000 barrels of benzine per annum. P. G. H.

1460. Polymer Gasoline Plant. Anon. *Oil & Gas J.*, 3.10.35, **34** (20), 26.—A commercial polymerized gasoline unit, producing 1000 brl. of gasoline daily, is being operated at a Borger (Texas) Refinery. The charging stock varies from natural gas to cracked gases containing up to 40% unsaturateds, the operating conditions, which varies from 1000 to 3000 lb. pressure and 950 to 1100° F. temperature, depending on the composition of the charging stock. The charged gases are compressed and passed into fractionating equipment where H_2, CH_4, and C_2H_6 are discharged and the higher molecular weight gases charged into the polymerizer. From the latter, H_2, CH_4,

recycle gas, gasoline and a trace of gas oil are removed and passed to the fractionator, where the H_2 and CH_4 are taken off as fuel gas, the recycle gas is returned to the polymerizer and the gasoline distilled to the required end-point.

The polymerized gasoline has the following properties: A.P.I. 60–64°; I.B.P. 94° F.; 20% dist. to 140° F.; 50% dist. to 170° F.; 90% dist. to 330° F.; E.P. 400° F.; octane blending value with respect to Reference Fuel A, 80 to > 100; saturation (acid absorption), 80–86% insoluble.

The gasoline is stable and non-gum forming, and is easily refined with light clay or acid treatment. C. L. G.

1461. Aluminium Stearate Grease Quality Depends on Exact Manufacturing Control. J. McKee. *Nat. Petr. News*, 16.10.35, **27** (42), 24D.—The physical properties of an aluminium stearate grease depend on (*a*) the quantity and quality of the stearate, (*b*) the viscosity of the oil vehicle, (*c*) the rate of cooling after mixing. Aluminium stearate is made in various types to give high and low bodying effects. A series of experiments have shown that, other things being equal, the penetration of a grease increases with increase in the viscosity of the oil vehicle. This effect is greatest when the oil is of paraffin base, when, also, the grease is softer than with naphthenic base or asphaltic base oils. The slower the rate of cooling after mixing the higher the penetration of the grease. Comparatively rapid cooling will produce a grease so hard that it will crumble on stirring, the constituent oil separating out from a granular mass.

The time during which the grease is maintained at the mixing temperature, 150° C. in the experiments cited, also affects the final consistency. With the usual slow cooling after mixing, it was found that the longer the mixing time the harder is the grease. Coincidently, however, the moisture content of the grease had fallen. This fall in moisture content is suggested as the cause of the fall in penetration. H. G.

1462. Manufacture, Packaging and Shipping of Oxidized Asphalts (Articles 7 and 8). C. J. Holland. *Petr. Eng.*, Aug. 1935, **6** (12), 36 and Sept. 1935, **6** (13), 36.—The remainder of the fifteen fundamental principles involved in the design and operation of oxidized asphalt plants are discussed. The results of experience indicate that in a continuous unit of capacity not more than 5 tons there should be six to eight small stills, particularly when making high-melting-point products, where rapid coke formation necessitates frequently cleaning of the last two or three stills. External direct-bottom heating of all stills is preferred to internal indirect heating, and should not extend around the sides, owing to damage to rivets and more expensive foundations and fire-boxes required. The stills and flow line should be set on the same level, cascade arrangements requiring additional erection and maintenance costs. Paddle agitation facilitates contact between the air and asphalt, reducing air and fuel consumption, coke formation and frequency of cleaning, particularly in the last stills. Of theoretical interest is the possibility of utilizing in a continuous unit the excess exothermic heat of the air–oil reaction in refluxing without the use of closed coil heat exchangers, thereby conserving air and fuel and giving flexibility of control and improved products. Thus if the material in the last still is off specification, it can be corrected by adjusting the rate of reflux. Drum filling and receiving vessels of great length and shallow depth are preferred when lay-out of plant, etc., permits this. The possibility of simultaneous production of two or more grades of asphalt from different stills, whether steam refined or blown, should be considered.

Based on these principles, an oxidizing plant in Mexico has been designed to operate on a charging stock of Panuco 180–200 or 130–150 pen bitumens taken at a storage temperature of 200° F. Recommendations are given for the most suitable size of pumps, lines, valves, fittings, air equipment and stills. It is calculated that in order to give an output of 5 tons per hour, there should be a battery of eight $15\frac{1}{2} \times 8$ ft. stills set up at 7 ft. above ground level. Indications are given of the necessary adjustment to the operating conditions in plant No. 1 in order to suit Mexican charging stock. C. L. G.

1463. Insulating Tanks and Stills. M. C. Cockshott. *Petr. Eng.*, Sept. 1935, **6** (13), 27.—A method is outlined for the replacement of the insulation on small tanks, stills and other circular vessels by ordinary maintenance crews, an example being given of the treatment of a circular shell 8 ft. in diameter and 60 ft. high. A suitable scaffold with a light single block and line is first erected, and alternate blocks of magnesia, 36 in. and 18 in. in height, placed around the shell, being kept in place by strips of

rubber cut from old automobile tyres and tied together. The remainder of the blocks to cover one section of the shell are then pushed into place and tightly bound with wire, additional packing specially cut to shape being placed around fittings and all protuberances, and being then well smoothed out with a paddle.

Small-mesh chicken wire is then applied all round the section and the remainder of the sections are completed in the same way. All cracks and crevices are carefully filled up with pieces of magnesia, and the whole is coated with asbestos cement trowelled on, two coatings being preferred. A final coat of an asphaltic compound is then applied, this being easier to fix and repair than a canvas coat, which requires stitching on.

It has been found that two men can block a 70-ft. still, 6 ft. in diameter, in 10 hrs., apply an insulating cement coat in 8 hrs. and an asphalt coat in 11 hrs., including moving and mixing of materials, but not erection of scaffolding. C. L. G.

1464. Petroleum Refineries. Anon. *World Petroleum*, 1935, **6**, 570.—The issue contains a number of articles devoted to descriptions of refineries and to details of completed and projected additions to plant, daily capacities and products manufactured. The countries covered comprise N. and S. America, Gt. Britain, France, Italy, Rumania, Russia, etc. In addition, a list of the petroleum refineries of the world arranged by countries, but excluding U.S.A., is given. This list shows the name of the company, location of plant, daily capacity, products handled and gives a brief description of the plant available. R. A. E.

1465. Need for Heat-Resisting Steel Alloys. T. H. Nelson. *Oil & Gas J.*, 3.10.35, **34** (20), 26.—Modern refinery operating conditions call for steel alloys of adequate corrosion resistance as well as physical properties. The choice of the alloy to be used should depend on the following factors: (1) Strength of material at the temperatures involved; (2) Limiting load or stress for duration of steel; (3) Chemical resistance to by-products of combustion or other chemical atmosphere or liquids; (4) Adequate composition to resist detrimental change, *e.g.* embrittlement or carbide precipitation, at the temperature obtaining.

The results of tensile strength tests at elevated temperatures or test bars of different chemical analyses (data quoted) assist the refiner in this direction. Below 1200° F. it is possible to use materials of low alloy content, *e.g.* C–Mo, Cr–Mo, Cr–Va–Mo, Cr–Ni–Va, Cr–Ni–Mo, Cr–Si–Mo, 4–6% Cr and 4–6% Cr with Wo or Mo. Above 1200° F. it is generally necessary to use alloys containing 20% alloy content, *e.g.* Fe, Ni or Cr with the usual addition of Si, Wo, Mo, Va, Ti, etc., according to the purpose in view. The lower alloy steels in many cases lack sufficient corrosion resistance or physical properties at elevated temperatures, but are cheaper than the higher alloys, so that their use, even with shorter life, is frequently economic. In some cases, however, it is necessary to use the more expensive higher alloys in order to obtain the required corrosion resistance and creep values.

The life at high temperature of such alloys cannot be gauged by their behaviour at low temperature, being limited by the creep or plastic flow at higher temperatures under stress. It is not possible to carry out extended tests, in relation to the working life of the alloy, so that extensive extrapolation of results over a series of shorter periods is necessary. Great variations in results of creep tests on the same material have been found, calling for better standardization and collaboration in tests, particularly with the more complex alloys. Although short-period creep tests do give indications of value, assessment is complicated by the difficulty of duplicating in test pieces, the design, cross section, chill and their effect on the inherent structure of the lighter alloy materials. This is illustrated by photomicrographs showing the crystalline structure of three different Fe-Cr-Ni alloys cast under identical conditions. Short time tests place the alloys in reverse order to those taken over a 5000-hour period.

It is recommended that careful study of the inherent cast structure should be made, particularly owing to the fact that uniform crystal structure with high alloyed materials is frequently difficult to obtain. The results of corrosion by H_2S tests on a series of steels of different composition at elevated temperatures are quoted from a paper by W. H. Hatfield before the British Iron and Steel Institute in May 1927. C. L. G.

1466. Patents on Cracking, H. Sydnor. U.S.P. 2,015,733, 1.10.35. Crude oil is reduced by flash vaporization to yield a residue and heavy and light naphthas. The heavy naphtha is heated to cracking temperature and introduced into the upper part

of a digestion zone together with gas oil previously heated to cracking temperature. The hot crude residue is introduced into the lower part of the zone from which oil and vapour are removed.

A. P. Sachs. U.S.P. 2,016,297, 8.10.35. Simultaneous vapour-phase cracking of naphtha and gas oil by the aid of a heated heat-carrier gas. Naphtha is present in the mixture in sufficient quantity to lower the partial pressure of the gas oil.

R. F. Trow. U.S.P. 2,016,304, 8.10.35. Distillate stock is heated under pressure to cracking temperature and so maintained in a zone where separation of vapours and liquid takes place. The vapours are fractionated under pressure, and the condensate is recycled together with preheated stock.

J. C. Morrell. U.S.P. 2,016,339, 8.10.35. Motor fuel is separated into light and heavy fractions, the latter is reformed at above 850° F. and blended back with the light fraction.

L. C. Huff. U.S.P. 2,016,371, 8.10.35. Crude oil is distilled by the heat of cracked vapours and the residue flash-distilled by pressure reduction. The combined vapours are dephlegmated in contact with the crude residue, the reflux condensate and unvaporized residue forming the cracking stock.

E. F. Nelson. U.S.P. 2,016,386, 8.10.35. Hot cracked products are passed through a vertical tube located within the reaction chamber and extending from near the top to the bottom of the reactor. A venturi throat is provided at the upper end of the tube, so that the downward passage of the cracked products induces a circulation of material inside the reactor.

H. C. Pennrich. U.S.P. 2,016,651, 8.10.35. Gas oil is heated to cracking temperature by rapid admixture with strongly heated refractory hydrocarbons. When reaction is complete, it is terminated by the addition of cool vapours or oil to the cracked oil.

J. B. Heid. U.S.P. 2,016,781, 8.10.35. Charging stock is separated into low- and high-boiling fractions, each of which are cracked under independently controlled conditions. Insufficiently converted intermediate products are subjected to conversion together with high-boiling fractions of the stock.

M. B. Cooke. U.S.P. 2,016,798, 8.10.35. Oil is preheated by indirect contact with hot combustion gases and then subjected to a topping operation. The topped oil is again heated by means of combustion gases, then vaporized and brought into direct contact with the hot combustion gases, in order to effect decomposition into gasoline.

R. F. Trow. U.S.P. 2,016,948, 8.10.35. Cracking stock is distilled to give a clean gas oil fraction which is cracked. The products are mixed with the residue of the charge, and the mixture is transferred to a plurality of reaction vessels, where it is further cracked and vaporized.

R. F. Trow. U.S.P. 2,016,950, 8.10.35. Oil is subjected to viscosity-breaking conditions of cracking and the products are passed to a distillation zone in direct contact with hot vapours produced in another part of the system. Light vapours are condensed and the reflux condensate is highly cracked and discharged into a series of reaction chambers. Separated vapours are passed through the series of chambers, from each of which separated liquid is withdrawn, the vapours finally being fractionated.

C. H. Angell. U.S.P. 2,017,836, 22.10.35. A combined coking, cracking and reforming process. The vapours from the coking operation are separated into a gasoline and a heavier fraction, the former being subjected to reforming conditions of temperature and pressure, and the latter being cracked. The products are blended and distilled and the residue is returned to the coking operation.

G. N. Harcourt. U.S.P. 2,017,860, 22.10.35. A process in which the overhead product is controlled to permit only the fractions desirable in the final product to pass through the refining stage. This is effected by using part of the condensate as reflux injected at the top of the column.

P. H. Sullivan. U.S.P. 2,017,874, 22.10.35. A combination liquid and vapour-phase cracking system, in which the gases obtained during the final fractionation are separated into permanent gases (*e.g.* H_2 and CH_4) and gaseous olefines. The latter are blended with the charging stock for polymerization in the preliminary, mild liquid-phase cracking operation.

R. F. Trow. U.S.P. 2,018,475, 22.10.35. A multi-stage process designed to give a high yield of gasoline and a low yield of heavy distillate from a dirty stock. Provision is made for stripping the various residues withdrawn from the reaction vessels, whereby residual fuel oils of desired characteristics may be obtained.

F. Winkler and P. Feiler. U.S.P. 2,018,619, 22.10.35. Apparatus for vapour-phase cracking in which those portions coming into contact with hydrocarbon consist of a material prepared by burning a moulded mixture of silicon with an addition of a ceramic binding agent.

J. C. Black. U.S.P. 2,018,654, 29.10.35. A heavy oil is cracked and another stock is simultaneously cracked using the waste combustion gases from the first cracking as the heating medium. The product of the latter operation is fractionated, and a portion of the heavy distillate injected into the first cracking coil in order to prevent excessive decomposition therein.

C. H. Angell. U.S.P. 2,018,699, 29.10.35. Reflux condensate from a cracking operation is heated under pressure and passed to a reaction zone. The products are blended with those of the primary cracking and passed to a separating zone.

C. P. Dubbs. U.S.P. 2,018,708, 29.10.35. Oil is cracked, passed to a reaction zone and vapours are withdrawn from a point remote from the inlet. The low-level of liquid thus obtained in the reactor prevents the production of carbonaceous or pitchy residue. The vapours are fractionated and the reflux condensate is recycled.

W. G. Whitman. U.S.P. 2,018,986, 29.10.35. Vapours from a cracking operation are passed at high velocity to a fractionating column, where they are cooled by indirect heat exchange with fresh oil. The oil thus preheated is discharged at an intermediate point in the transfer line. Unvaporized oil and reflux condensate are collected without admixture with the unvaporized liquid from the reaction chamber.

C. B. Buerger. U.S.P. 2,019,070, 29.10.35. Vapour-phase cracking in which the cracking stock is contacted with cracked vapour in order to distil it. The mixed oil vapours are subjected to partial reflux condensation and the condensate so formed is used to produce the cracked oil vapours.

W. L. Gomory. U.S.P. 2,019,448, 29.10.35. Cracking stock is vaporized and the reflux condensate obtained is cracked, the product being discharged into the vaporizing zone. The residue is removed and cracked or hydrogenated. W. H. T.

1467. Patents on Hydrogenation. Yorkshire Tar Distillers Ltd., E.P. 435,192, 13.9.35. Catalytic hydrogenation of cresols, the catalyst being metallic thiomolybdate or cobalt thiomolybdate.

I.G. Farbenind. A.-G. E.P. 435,254, 9.9.35. Production of unitary polynuclear carbon compounds containing at least four nuclei, by the destructive hydrogenation of bituminous materials (except high-temperature tar). The desired material is obtained from the high-boiling fractions of the resulting product.

F. Uhde. E.P. 435,457, 20.9.35. A hydrogenation process in which solid reaction products are withdrawn, dried and reduced in order to reform the metal of the catalyst from the oxide. The reduced products are returned to the high-pressure reaction vessel.

Soc. Ind. Carburants et Solvents. E.P. 435,717, 26.9.35. Two-stage, vapour-phase catalytic hydrogenation of naphthaline. In the first stage, the catalyst may be one of Fe, Cu, Ni, Co or Cr, while in the second it comprises porous carbon impregnated with Ca, Fe, Cu, Ni, Co, Cr or their oxides.

W. W. Triggs. E.P. 435,809, 30.9.35. Oil vapour, hydrogen and oxygen are passed over oxidation-promoting catalysts (Mo, V, Wo, Pt, Pd, Si, Cu, Ag, Fe, Co, Ni, Mu, Zn, etc.). Excess of hydrogen together with the products of the above reaction is passed over a catalyst in order to effect hydrogenation.

R. H. Griffith, R. N. Beresford and S. G. Hill. U.S.P. 2,016,169, 1.10.35. Hydrogenation of high-boiling hydrocarbons at 340–550° C. and above 50 atm. pressure, in the presence of a catalyst comprising a basic oxygenated titanium salt of an acidic oxide chosen from the group vanadium, molybdenum or tungsten.

J. D. Zieley. U.S.P. 2,017,226, 15.10.35. Mariel (Cuban) asphalt residues are used as a catalyst for the hydrogenation of hydrocarbons.

P. L. Young. U.S.P. 2,018,772, 29.10.35. Hydrogenation of unstable gum-forming oil under pressure at 200–500° F. A stable heavier oil is preheated to above 500° F., mixed with the unstable oil and the mixture hydrogenated. W. H. T.

1468. Patents on Refinery Plant. Bat. Petm. Mij. E.P. 435,230, 17.9.35. Gasoline is fractionated sufficiently sharply at the temperature corresponding to the break in the H.U.C.-volatility curve, that the A.S.T.M. boiling range of the distillate does not overlap that of the next higher fraction. A gasoline is thus obtained, having a volatility corresponding to that indicated by the break in the H.U.C.-volatility curve.

P. D. Walmsley and W. B. Kendall. E.P. 435,867, 1.10.35. A still for the distillation of volatile constituents from wash oils. It comprises a packed tower with an interior heating tube around which packing is arranged in annular form. An inlet is provided for the introduction of the charge to the upper part of the annulus, and the oil flowing down the annular packing is directed on to the heating tube by means of conical slotted elements.

J. W. Packie. U.S.P. 2,015,725, 1.10.35. A bubble-cap fractionating tower fitted with an internal stripper, whereby a liquid fraction may be removed from any desired point and stripped of its low-boiling constituents by counter-current treatment with a vapour or gas or by subjection to a lower pressure.

P. W. Merchant. U.S.P. 2,016,336, 8.10.35. A type of orifice mixer in which streams of oil and reagent are brought together at right angles and the commingled liquids caused to be dashed against a surface. The direction of flow from the surface is then reversed, thereby bringing about a high degree of turbulence.

H. F. Fisher. U.S.P. 2,018,302, 22.10.35. Apparatus for breaking emulsions of oil and water in which the emulsion is brought into contact with a mixture of two minerals, one preferentially wetted by oil and the other by water.

L. D. Jones. U.S.P. 2,018,309, 22.10.35. Non-cracking distillation of heavy oil in which the oil is contacted with a carrier-vapour at a sufficiently high temperature to effect partial vaporization. The temperature of the mixed vapours is reduced sufficiently to condense oil therefrom, and the residual vapours are contacted with another quantity of oil previously heated to a temperature higher than that of the vapour. Oil is again condensed from the mixed vapours.

K. Ebner. U.S.P. 2,018,778, 29.10.35. Vacuum distillation in which oil is pre-heated and conveyed into a vaporizing chamber by the air-lift effect induced by the injection of a relatively low-boiling liquid. The vaporizing chamber is maintained under a vacuum, vapours are removed and condensed, whilst unvaporized material is returned to the pre-heater.

J. T. Shaler. U.S.P. 2,018,976, 29.10.35. Corrosion of pressure-vessels is prevented by the provision of a diaphragm which separates the space beneath the head of the vessel from the cylindrical body. Passages are provided for drainage and equalization of pressure differences between the two spaces. W. H. T.

1469. Patents on Gas. G. F. B. and R. D. Keillor. E.P. 436,211, 8.10.35. Partly spent ferric oxide which has been used to extract sulphur from gases is heated to the melting point of sulphur, and then subjected in a fine state of division to the scavenging action of steam. The product is used as a weed-killer.

R. F. Ruthruff. U.S.P. 2,017,325, 15.10.35. A process for the polymerization of gases (at 750–1000° F. and 500–3000 lb. per sq. in.) in which liquid products are separated from unreacted gases in at least three stages at progressively lower pressures. Fixed gases are removed in the first stage, and olefinic gases are separated from subsequent stages and recycled, saturated gas being eliminated from each stage.

V. Ipatieff. U.S.P. 2,018,066, 22.10.35. Polymerization of olefinic gases, using a solid phosphoric acid catalyst. Steam is added to the reacting materials in such an amount that the vapour pressure of the acid at the operating conditions is balanced by the steam in the gas and loss of water from the catalyst is substantially prevented. W. H. T.

1470. Patents on Motor Spirit. W. A. Patrick. E.P. 435,194, 16.9.35. Refining light oils by heating in contact with a sulphur chloride (0·15% using a catalyst, or 0·3% without catalyst) for just sufficient time (30 mins.) to allow reaction with unstable, unsaturated aliphatic hydrocarbons, resinous or asphaltic materials and sulphur compounds. These are converted into high-boiling, stable compounds of reduced solubility which can be removed by distillation.

Fuel Dev. Corpn. E.P. 435,787, 27.9.35. A method of adding an anti-detonating liquid to the normal intake of an I.C. engine by means of a supercharger.

Soc. Anon. d'Ougree-Marikaye. E.P. 435,965, 2.10.35. Refining benzoles, petrols, etc., by treatment with ammonia followed by water washing. An oxidation inhibiting agent is added to the treated product. When the sulphur content of the treated products is greater than that desired, a fraction (80–120° C.) is treated with acid in order to eliminate thiophene.

N. F. Black and J. A. Tilton. U.S.P. 2,015,703, 1.10.35. Motor fuel, prepared by

the hydrogenation of high-boiling hydrocarbons, is refined by treatment with 98% sulphuric acid at 35–80° F. The material is thus rendered gum and colour stable without loss of anti-detonating value.

A. E. Buell and W. A. Schulze. U.S.P. 2,016,271 and 2,016,272, 8.10.35. A method of sweetening motor spirit in which the material is vaporized, the vapours heated to 606–750° F. and then passed through a bed of crushed bauxite at a rate equivalent to 8–20 brl. of oil per hour per ton of catalyst. The mercaptans are thus converted into hydrogen sulphide, which is removed on condensing the treated vapours. In the second patent the vapours are heated to 500–800° F. and contacted for 2–10 seconds with a mineral ore containing a substantial proportion of catalyst.

P. S. Nisson. U.S.P. 2,016,342, 8.10.35. A sweetening process which comprises treatment with sodium plumbite, adding a slight excess of sulphur. The reaction products are separated, and the reaction is completed by treatment with a solution of a salt of hypochlorous acid (*e.g.* sodium or calcium hypochlorite).

D. R. Stevens and W. A. Gruse. U.S.P. 2,017,610, 15.10.35. A process of refining cracked spirit, the treating agent being the reaction product of coal tar acids with sulphuric acid.

T. T. Gray. U.S.P. 2,019,184, 29.10.35. Sweetening gasoline by vapour-phase treatment with fuller's earth at 550–850° F. W. H. T.

1471. Patents on Lubricating Oil. I.G. Farbenind. A.-G. E.P. 435,548, 17.9.35. A lubricant comprising oil or grease and sulphur compounds formed by the reaction of sulphur with hydrocarbons of high molecular weight which hinder oxidation.

I.G. Farbenind. A.-G. E.P. 435,597, 17.9.35. Synthetic lubricants (*e.g.* formed by condensation or polymerization of hydrocarbons) are improved by the addition of organic oxygen compounds. The latter contain a cyclic radical and at least one oxygen atom directly connected with two different carbon atoms and act as anti-oxidants.

I.G. Farbenind. A.-G. E.P. 435,598, 17.9.35. Preparation of synthetic lubricants by condensation or polymerization of high-molecular-weight hydrocarbons in the presence of amines or other organic bases or nitrites.

Akt. Separator Nobel. E.P. 435,648, 25.9.35. Dewaxing by mixing the oil and wax with solvent of higher gravity than the heaviest wax to be removed, followed by chilling and centrifuging. A solvent of lower gravity and insoluble in the first solvent is fed into the centrifugal bowl simultaneously with the oil to be dewaxed and leaves the bowl together with the wax.

Sharples Spec. Co. E.P. 435,826, 30.9.35. Continuous treatment of oil with acid. Known mixtures are intimately mixed for less than 4 minutes at a rate equivalent to 0·4–2·8 B.Th.U. of work per lb. of oil treated. Sludge is immediately separated from the treated oil by means of a centrifuge.

H. Suida, H. Pöll and A. Nowak. E.P. 436,194, 7.10.35. Separation of oil into paraffinic, naphthenic and aromatic components by the solvent extraction effect of a mixture of cresol and a water-repellent liquid solvent (*e.g.* nitrobenzene) which has a selective action between paraffinic and naphthenic oils. The mixture is applied in the anhydrous state for the separation of the paraffinic constituents and saturated with water for the separation of naphthenic components. The aromatic, resinous and asphaltic materials are left in the mixture of solvents saturated with water. The sequence of extraction may be altered to allow of a preliminary extraction of aromatic, resinous and asphaltic compounds. W. H. T.

W. H. Bahlke. U.S.P. 2,017,432, 15.10.35. Refining of lubricating oils by extraction and dewaxing by a method in which the dewaxing diluent aids in the extraction and the extraction solvent aids in the dewaxing. The oil is diluted under pressure with liquefied propane, and the diluted oil mixed with dichlorethyl ether and cooled by flashing a portion of the propane. An extract phase containing naphthenic compounds and a raffinate phase containing paraffin compounds are formed. These two phases are separated and the wax is precipitated from the raffinate in the presence of liquefied propane and dichlorethyler. The wax is then separated from the oil solution and the propane and ether recovered from the raffinate phase.

F. S. Clulow. U.S.P. 2,017,529, 15.10.35. Preparation of coloured lubricating oils by compounding a mineral oil and oil-colouring portion of pitch of flash point 325° F. The latter is obtained by the pyrolytic decomposition at atmospheric pressure of a hydrocarbon oil heated to 1400° F. in a refractory chamber in the presence of steam.

J. W. Poole. U.S.P. 2,017,730, 15.10.35. Refining of lubricating oils by treatment with an unsaturated aldehyde selected from the group containing crotonaldehyde and acrolein. Three phases are formed—oil, solvent, and a solid or semi-solid phase including paraffin wax. These are separated by centrifugal force and the solvent may be recovered from the oil phase by distillation.

J. Schulze. U.S.P. 2,017,820, 15.10.35. Manufacture of lubricating oils by vacuum distillation in the presence of caustic soda under an absolute pressure of 25 mm. Hg.

S. C. Fulton. U.S.P. 2,018,715, 29.10.35. Improvement of lubricating oils by heating with a mixture of 1 part by weight of 66° Bé sulphuric acid, 1 part by weight of glacial acetic acid and 1 part by weight of formaldehyde.

M. Pier and A. Eisenhut. U.S.P. 2,018,871, 29.10.35. Production of lubricating oils of high viscosity index (120 or $>$ 120). The oil, substantially free from asphalt and paraffin wax, is treated with a mixture of propane and ethane when constituents of high molecular weight are precipitated. The oil is withdrawn from the oil–propane mixture, the propane removed, and to the resulting oil is added an oil-soluble synthetic product of high molecular weight which is richer in hydrogen than the precipitated constituents of high molecular weight.

E. Ayres and H. G. Smith. U.S.P. 2,019,037, 29.10.35. Treatment of lubricating oil stock by contacting with dry hydrogen chloride and adding a suitable proportion of anhydrous aluminium chloride at 300° F. After agitating, the sludge is separated from the residual oil, and the oil is neutralized. The aluminium chloride sludge is decomposed with dilute sulphuric acid, the acid separated, and then contacted with clay and filtered. W. S. E. C.

1472. Patents on Fuel Oil. Gas Light and Coke Co. E.P. 436,027, 3.10.35. A fuel oil for compression ignition engines comprising a mixture of light creosote oil and gas oil with a small proportion of an organic compound containing a halogen atom and a nitrate group on adjacent carbon atoms in the molecule. It has an ignition point appreciably below that of the fuel alone.

E. Bluemner. E.P. 436,380, 10.10.35. Colloidal fuel is produced by heating to cracking temperature and under pressure a suspension of coal in oil. The suspension is heated in thin films and is centrifuged at sufficient speed to separate gases and vapours from the suspension, but insufficient to separate coal from the oil. W. H. T.

1473. Patents on Asphalt. A. Dacker Ges. für Electrochem. Ind. E.P. 432,406, 25.7.35. Preparation of solutions of a natural asphalt which is insoluble in benzine. The asphalt is dissolved in a solvent comprising a benzine as the volatile component and a small proportion of a carbonyl compound, which itself does not dissolve natural asphalt. W. H. T.

1474. Patents on Special Products. G. F. Horsley and I.C.I. E.P. 435,769, 27.9.35. Catalytic hydration of olefines in the vapour phase at 250–300° C. and at above 100 atm. The catalyst comprises 2 mol. proportions of aluminium metaphosphate associated with 1 mol. of a metaphosphate of Ca, Cd, Zn or divalent Cu, Ni, Sn or Pb.

E. H. Strange. E.P. 435,858, 1.10.35. Alkyl chlorides and/or bromides are prepared by reacting the appropriate hydrohalogen acid with olefines in the presence of a contact mass comprising an adsorbent metal oxide gel.

Stand. Oil Dev. Co. E.P. 436,044, 3.10.35. A cleaning, flushing and lubricating oil comprising a light lubricating oil and sufficient solvent that the composition has a kauri butanol value above 30. The solvent (30–300 secs. Say. at 100° F., b. pt. 70–500° C.) is selected from the following :—aliphatic hydrocarbons, alcohols, ketones, ethers, halogenated hydrocarbons and solvent extracts.

Bat. Petm. Mij. E.P. 436,357, 9.10.35. Treatment of unsaturated polyhalides with hypohalogenous acids, aqueous halogen solutions, etc., whereby polyhalogenated hydroxy compounds and/or polyhalogenated hydrocarbons are produced.

I.C.I. E.P. 436,653, 7.10.35. Diphenyl and chlorinated diphenyls are produced by passing benzene or monochlorobenzene vapours in admixture with chlorine and polychlorobenzenes through a reaction zone at 700–850° C., the reaction time being 2 secs. to 1 minute.

I.C.I. E.P. 436,661, 16.10.35. Preparation of naphthalene-1 : 2-dinitrile by interacting the sodium or potassium salt of 1-cyanonaphthalene-2-sulphonic or 2-cyanonaphthalene-1-sulphonic acid with sodium or potassium cyanide or ferrocyanide.

Bat. Petm. Mij. E.P. 436,840, 18.10.35. Oxidation of unsaturated primary and

secondary alcohols (4 C atoms per mol. and one olefinic linkage) to unsaturated aldehydes and ketones in the presence of catalysts at 300–550° C. W. H. T.

Bat. Petm. Mij. Dutch P. 67,663, 5.12.33. Wave-breaking oil is prepared by mixing a mineral oil of low wax content with organic acids of high molecular weight. P. C. K.

1475. Patents on Coal. E. W. Brocklebank, W. B. Mitford and C. H. Lauder. E.P. 435,187, 9.9.35. Preparation of solid smokeless non-clinkering fuel (cf. E.P. 421,556) in which a mixture of coking and non-coking coals, having an ash content of over 10%, is ground to a fine powder in order to distribute the ash evenly through the material. W. H. T.

Class 700. Utilization.

1476. Practical Study of Carburation. M. Puisais and M. Moynot. *Ann. Des Comb. Liq.*, 1935, **10**, 663–678.—The arrangements made at the " Station Nationale d'Essais de Bellevue " in order to measure air/fuel ratios of engines operating under normal controlled working conditions are described.

The apparatus described consists of an air bell, constructed in aluminium of 1 mm. thickness, which is accurately counterpoised. The chain carrying the counterpoise is of such dimensions that the change in water pressure in the bell due to partial submergence of the bell, is counterbalanced by the difference in the weight of the two sections of chain passing over the pulley. The bell has a capacity of about 7 cubic metres of air, and an electrical device records the removal of each cubic metre of air, which leaves the bell through a tube 14·5 cm. in diameter. The final connection to the engine is by means of a rubber hose, to minimize vibration. It is considered that air measurements can be made which are accurate to $\pm$ 0·74%. The engine fuel is metred by means of Mariotte bottles of variable height above the inlet jet, the usual type of carburettor being abandoned. Three jet sizes allow good operation over the whole range of fuel supplies necessary. Problems capable of accurate measurement besides air/fuel ratios include the correspondence between the latter and those calculated from exhaust gas analyses either complete or simply for CO_2, O_2, and CO, influence of mixture strength on power and consumption, and the influence of mixture temperature on power and consumption for different air/fuel ratios.

This article is illustrated with photographs. W. E. J. B.

1477. Progress of the I.C. Engine and its Fuel. H. R. Ricardo. *Engineer*, 1935, **160**, 4163, 433–434.—The author gives an interesting account of the early troubles associated with internal-combustion engines; in particular, the petrol engine. He describes how the phenomenon of detonation or pinking was discovered, and gives an account of the evidence leading to his present conclusions with regard to the factors controlling detonation in an engine. He states that the anti-knock value of the fuel, as expressed by its octane number, has increased in importance, until now it may be said to control the maximum efficiency of an engine.

Looking ahead, the author suggests that if 100 octane number fuel becomes available for aircraft, the best performance will be obtained not by increasing compression ratios above their present values, but by employing heavy supercharge; which might be provided by an exhaust-driven turbine. The supercharger would also provide for scavenging to get rid of the larger amounts of waste heat; in which case the carburettor would be abandoned in favour of fuel injection.

In the case of heavy commercial engines, the author believes that the petrol engine will almost entirely be superseded by the compression ignition engine.

The process of combustion in the C.I. engine is described, and the importance of arranging that the ignition delay angle shall be as short as possible is stressed. The various methods of shortening the delay angle are outlined, and the author concludes by giving a few hints on fuel quality, in which attention is directed to the difficulty of drawing up a fuel specification for C.I. engines, on account of the widely differing requirements of the various designs of engine. J. G. W.

1478. Vaporizer for Wet Fuel Gas. S. B. Crissey. *Petr. Eng.*, Sept. 1935, **6** (13), 76.—The removal of particles of gasoline from casing-head gas used as fuel in low-compression engines has been effected by a vaporizing coil heated by the exhaust pipe of the engine.

A U-shaped coil of 2-in. tube was set with one limb in the exhaust pipe and one just outside. The gas from the scrubber passes through the tube inside the exhaust pipe, and any particles of gasoline are vaporized, a regulator being placed between the coil and the throttle.

This vaporizer has eliminated trouble due to the knocking caused by the wet gas and to the leakage past the piston rings resulting in scored pistons and cylinder walls and lost lubrication. C. L. G.

1479. Bituminous Paints for Use Under Water. E. Kindscher. *Oel u. Kohle*, 1935, **11**, 669–672.—Paints with a bituminous base are shown to be the most satisfactory type for use on iron and steel under water. Their properties are adjusted to meet the special conditions by admixing other materials (natural asphalt, inorganic fillers, rosin, etc.) with the bitumen. Water-insoluble fillers raise the softening point without increasing tendency to crack or sensitivity to shock. Fillers which are sensitive to water (*e.g.* clays) reduce the water resistance of the paint.

The paints may be applied (*a*) in cold solution or (*b*) by brushing in the melted condition. Bituminous solutions are used chiefly for structures submerged in fresh water and require a very quick drying red-lead undercoat. Method (*b*), which is applied chiefly to sea-water work or in cases where high resistance to chemical attack is required, may be used on the iron work without an undercoat. P. G. H.

1480. Anti-Rusting Paints. A. V. Blom. *Paint Manufacture*, 1935, **5**, 292–296.—This is a report of tests carried out in Switzerland on anti-rusting paints with special reference to under-water paints at sixteen test stations and extending over three years.

The test paint coatings were suitably applied to emeried iron panels 20 × 30 cm., which were then exposed in large iron frames. The iron used in all tests came from the same manufacturing batch.

Methods of exposure included (*a*) constant immersion in either motionless or flowing water, (*b*) alternate immersion in water and exposure to air (with and without sun), (*c*) exposure to weather (both mountain climate and town climate included).

The following classes of paints have so far been tested: (1) Oil-bitumen varnishes (relatively high oil content), (2) short bitumen varnishes (little or no oil), (3) bitumen emulsions, (4) oil paints, (5) synthetic resin varnishes, whilst various primers have been used. Tables of results and photographs of typical panels are given.

It is concluded that steels with a minimum rusting tendency should be used and the construction should be completely accessible to the brush or spray gun. Bitumen varnishes, when applied direct to the iron surface, are satisfactory under alternating air–water exposure conditions if not too brittle and if applied sufficiently thickly. They chalk in sunlight unless provided with a top coat of aluminium pigmented varnish.

Hot bitumen masses are satisfactory for large continuous surfaces, but not for girder-like structures. Good results are given by bitumen emulsions and synthetic resin varnishes, although the latter have the disadvantage of requiring more than a week to dry through. Oil paints will weather satisfactorily only when a basic lead paint primer is used to retard rusting. For total immersion in water, a finishing coat of bituminous or synthetic resin paint is necessary.

The investigation is being continued. D. L. S.

1481. Petroleum Products in the Textile Industry. Technical Aspects of Lubrication Problems. Anon. *Olii Min.*, 1935, **13**, 81–82, 97–100, 115–116.—Compound oils containing lard, olive or arachis oils with mineral oil can replace straight fatty oils in the treatment of wool to make the latter soft and to facilitate smooth running during spinning, combing and carding. Emulsions of the above with water are used. The product should contain a minimum amount of free fatty acids, it should have a high flash point, a minimum tendency to oxidize or form gum, and should be sufficiently fluid to penetrate the fibre. Non-drying fatty oils must be used. Mixtures which form stable and viscous emulsions are desirable, as the product can then be readily washed out from the fabric, leaving no permanent stain. Mineral oils have very low acidity, and reduce the tendency of the fatty oil to become rancid. They are non-gumming, non-oxidizable, and there is no risk of spontaneous combustion. In addition, mineral oils tend to loosen the natural fatty bodies present in the fibre.

In the manufacture of knitted goods most of the above considerations apply; acidity or alkalinity must be absent to avoid corrosion of the metal. The maximum

proportion of free fatty acid permitted in wool oils varies according to different observers from 6 to 20%. For those parts of the machine in close proximity to the fabric, a compounded oil of viscosity 6° E. at 20° C. is used, whilst a compound oil of 4·5° E. at 50° C. made from a pale mineral oil base is suitable for lubricating bearings and transmission working in a humid atmosphere. For normal bearings, cams, etc., a straight mineral oil of viscosity 3–4·5° E. at 50° C. is satisfactory. For ball and roller bearings, gears and transmission chains, a neutral semi-fluid grease is used. It is essential, of course, that any oil which may come in contact with the fabric shall not leave a permanent stain. The ease of removal of the compound is closely connected with the saponifiable nature and ease of emulsification of the oil used.

The application of mineral oils to cotton manufacture is more restricted than in the case of wool.

In the silk industry, the cocoon is immersed in a bath of hot water containing boracic soap and oil (neatsfoot, olive, lard or compound oils), in order to soften the gummy constituents and to make the fibre pliable. The oil must be odourless and of sufficient viscosity to form a resistant film on the silk. A suitable compound consists of 30% mineral oil (15° E. at 20° C., 200 sec. Saybolt at 38°) and 70% mineral oil.

Traces of oil, *e.g.* left in the fabric, may have a pronounced effect on the dyeing process. Since exhaust steam is used for heating the dyeing vats, contamination may occur by oil used in lubricating the steam cylinders being entrained in the steam, unless efficient separators are employed. C. C.

1482. Pump Lubrication. E. Sterrett. *Oil Weekly*, 21.10.35, **79** (6), 31.—By means of the installation of a few simple changes in the method of lubricating the crossheads of the gear-driven pumps a considerable quantity of oil was saved.

By plotting to scale the various portions of the crank pin with the crosshead at each end of the stroke, the portions where oil was interrupted and where wasted were found. The interruption of the falling drops of oil were found to be only 39% of each revolution, instead of 58%.

The lubricator was, therefore, moved from its central position, and a special feeder developed. As a result of this feeder, a large saving in oil was made. L. V. W. C.

1483. "Dope" for Embedding Wax. Waddington and Kriebel. *Nature*, 1935, **136**, 685.—The effect of small quantities of petroleum ceresins in causing paraffin wax to cool in a microcrystalline state (Higgs, *J.I.P.T.*, 1935, **21**, 1) has been utilized in the technique of cutting paraffin sections.

A mixture without beeswax, but containing 0·5% ceresin, gave satisfactory results, the wax cooling with a very fine texture even when only air cooled. It is necessary to use a mixture with a m. pt., before the addition of ceresin, slightly lower than is normally appropriate. The electrostatic properties of the wax appear to be unaltered. This "dope" may be useful in embedding large objects when ordinary wax tends to cool too slowly in the centre of the block. D. L. S.

BOOK REVIEWS AND BOOKS RECEIVED.

Reviews.

FUEL: SOLID, LIQUID AND GASEOUS. J. S. S. Brame and J. G. King. Fourth Edition. xvi + 422 pp. 1935, Edward Arnold & Co., London. 25*s*.

A NEW edition of this well-known and authoritative work has been long overdue, the more so because a large number of books dealing with the same subject have been published during the ten years which have elapsed since the third edition became available.

A comparison between the old and new editions provides a striking demonstration of the rapidity with which new knowledge accumulates and of the steepness of the downward trend in the utility–time curve in books dealing with technological subjects.

The progress made within ten years might well have justified a complete re-writing of the book, and it speaks well for the foundational strength of previous editions that this was not considered necessary. The original plan has been preserved so well that readers familiar with the older editions will not experience a sense of strangeness when perusing the new one.

Nevertheless, it is soon evident to the reader that a number of major surgical operations have been necessary and numerous graftings of new tissue upon the old skeleton. The authors are to be congratulated upon the way in which these operations have been performed, and upon their apparently painless nature.

The new edition is, in fact, no product of the plastic surgeon's art, not a patchwork of repairs on an old and worn-out frame; it is rather a complete rejuvenation and revitalization of the whole being, so as to endow it with a new lease of life.

A valuable feature of the work is the inclusion at appropriate places of the valuable results obtained as a result of years of research at the Fuel Research Station, Greenwich.

Much new matter has been incorporated in the section dealing with coal and its constituents, this including the more recent work of Bergius and the suggestive theories proposed by Berl and Schmidt, Mackenzie Taylor, Stone and Travers, as well as the important contributions of Bone, Horton and Ward, and many others.

The part referring to the utilization of coal would have been very incomplete without a reference to its application as fuel in a pulverized state, and this has been well taken care of by the authors, who have devoted about 8 pages to this subject.

The section on coke and coking has been brought well up to date, and includes, amongst other valuable information, an account of the methods developed by the Fuel Research Division, and by Mott and Wheeler, respectively, for the measurement of reactivity. Petroleum technologists will perhaps consider this section as incomplete, since no reference is made to the manufacture and properties of petroleum coke.

The second part deals with liquid fuels, and the first 18 pages provide a good general survey of what may be termed heavy fuel oils, suitable for steam raising or external combustion purposes.

The next 12 pages contain an excellent account of hydrogenation processes, chiefly as applied to coal and tar, the hydrogenation of petroleum residuals receiving only a brief reference.

Oil-fuel burning receives fairly extensive treatment, about 28 pages being utilized in describing various forms of atomizing burners, of the usual steam, air or pressure types, as well as devices for using liquid fuel for other purposes than steam raising. There is included in this section a short, but fairly comprehensive, discussion on the economic aspects of liquid fuel.

Motor spirit, in the form of gasoline, benzole and alcohol, or blends of these, is the subject of two separate chapters, which quite adequately cover the ground, in an interesting and informative manner.

Recent developments in compression-ignition engines, especially those of the diesel type for high speed, obviously called for special treatment, and this has been adequately provided in the section dealing with liquid fuels for this type of engine.

Part III, dealing with gaseous fuels, has needed considerable enlargement to bring it

up to date, and even the 78 pages allotted have not sufficed to cover the ground completely. Considerable space is devoted to water gas, and its enriched form known as carburetted water gas. The use of producer gas for motor transport is treated from the viewpoint of the vehicle carrying its own producer, but the application of gas compressed into cylinders for motive purposes is a modern development which has been omitted.

The use of compressed propane and butane for domestic heating and cooking has also been omitted from the text, although its extensive development abroad makes the subject of interest.

The fourth part, referring to analysis, calorimetry and control of fuel supply, has been brought thoroughly up to date. The importance of correct sampling is strongly emphasized, and methods for securing this necessary preliminary to all methods of analysis are either described in detail or made the subject of useful references.

In the section on calorimetry it is observed that the well-known and now classic illustration of the Mahler apparatus still appears, although it is doubtful whether any examples of this ancient appliance are now extant. It would have been useful to have illustrated more than one of the many types of modern bomb calorimeters, and especially of the very efficient modern types of power-driven stirrers, which add considerably to the convenience of operation.

Incidentally it is observed that the reference to the Parr apparatus is somewhat misleading, since it mentions only the sodium peroxide model, no reference being made to the Parr oxygen bomb, which has been in common use for over 20 years and was the first to be made of non-corrosive alloy, and the first to utilize the protected rubber gasket instead of the old lead seal.

Only a few minor errors or misprints were detected in a first reading of the book; on page 54, for instance, it is stated that a formula for the calculation of mineral matter from the ash percentage is to be found on page 55. Actually this formula appears on page 346, while on page 159 the surgeon's scalpel seems to have slipped and excised a letter from the word fuel.

The book is well printed, and the illustrations are beyond reproach, and altogether it constitutes a very valuable, and indeed a necessary, part of the literary equipment of all fuel technologists who desire to keep their knowledge up to date.

J. McConnell Sanders.

Drilling and Production Practice 1934. 200 pp. 1935, New York, American Petroleum Institute. $ 2.00.

This volume contains papers on drilling and production practice, selected by the Programme Committee of the A.P.I.'s Central Committee on Drilling and Production Practice, from papers delivered at national or district meetings of the Division of Production during the year 1934.

The purpose of this book is to preserve these especially selected papers in a more convenient form, and in more permanent binding, than has been possible with the yearly and semi-annual paper-covered bulletins giving the proceedings of annual and mid-year meetings.

The contents are divided into seven sections, namely: (1) Essential Engineering Factors in the Allocation of Production; (2) Drilling Practice; (3) Production Practice; (4) Geology; (5) Equipment; (6) General; (7) Bibliography.

Section (1). The curtailment of producing pools has created many problems in recent years, particularly from the standpoint of procuring maximum economic recovery from each pool and maintaining equity between the various productive tracts therein. In addition to the revised progress report of the topical committee on allocation of production, seven short supplemental papers are given in this section which should stimulate discussion on this important problem.

Section (2). Contains two papers on drilling practice, one of which describes a series of tests which was conducted to determine the factors which affect the magnitude of pressure drop which occurs when the drill-pipe is withdrawn from the hole, and the other deals with pressure completions of wells in West Texas using water (not drilling mud) as the circulating medium, the water being lightened with sufficient high-pressure gas to equalize the formation pressure in order to prevent penetration of the circulating water into the walls of the hole.

Section (3). The five papers contained in this section deal with acid treatment of

wells, reduction of lifting costs, oil-field explosives, application of thermodynamic data to production problems, and production in East Texas. Each of these papers contains illustrations, graphs or tabulated data of interest to the reader concerned with production problems, whilst the paper on oil-field explosives covers a subject which has not been dealt with to any great extent in the past.

Section (4). The geology of deep-sand development in the eastern area of Pennsylvania and the organic content of sediments are the two subjects dealt with in the papers forming this section of the book. The former summarizes the geology of the Oriskany sand development, and discusses the prospects for future development from a standpoint of structure, regional favourability and known characteristics of the sand. The latter gives a summary of the recent work on a research project relating to source beds of petroleum that is being carried out under the auspices of the U.S. Geological Survey and the A.P.I.

Section (5). This section contains three papers, one covering recent developments in joint design of tubular goods, one on the subject of drilling mud and full-hole tool joints, and the other concerns the history, development and application of the full-hole tool joint. A number of different types of casing joints are illustrated and described in the first paper, and their comparative strength and dimensions are tabulated. Results of tests on both welded and screwed casing joints are also tabulated, and three casing programmes are illustrated. Drill-pipe joints are also dealt with.

A study of the composition and behaviour of drilling mud, the quantities required for circulation and the reduction of friction losses by the use of full-hole tool joints comprises the subject matter of the second paper, and the purpose of the third paper is to acquaint those who may be interested with full-hole tool joints and the mechanical development thereof.

Section (6). The well-spacing problem, probabilities in relation to wildcat wells and accident prevention and its practical application to drilling and producing operations form the subjects of the three papers contained in this section.

Section (7). This, the last section of the book, contains a complete index of all papers presented at group sessions of the Institute's Division of Production at annual and mid-year meetings during the years 1927–1933, inclusive, commencing with Production Bulletin No. 201 up to and including Production Bulletin No. 212. The list does not include papers which were presented at district meetings.

As a whole the book contains much valuable information relating to modern technique in drilling and production practice. W. WADE.

PRINCIPES DE GEOLOGIE DU PETROLE. Jean Jung. viii + 184 pp. 1935, Librarie Polytechnique Ch. Beranger, Paris. Fr. 34.

IN the preface to this work Prof. Jean Jung states that although many excellent books have been published in English and German on the Geology of Petroleum, they are in the main highly detailed and technical.

He has therefore set out to deal with petroleum geology in the simplest possible manner by condensing into book form a course of lectures given by him at the Strasbourg, "l'Ecole Nationale Superieure du Petrole et des Combustibles Liquides."

The book is divided into five parts, dealing with :—

1. Origin of natural hydrocarbons, pp. 1–40.
2. Concentration and dispersion of oil, pp. 41–62.
3. Classification of deposits, pp. 63–90.
4. Geology in prospecting and exploration, pp. 91–124.
5. The world deposits of petroleum, pp. 125–178.

From the above it will be realized that the process of condensing has been a severe one, with the result that, although practically all subjects under the above headings are touched on, there is little in the book that is either new or sufficiently detailed to be of value for reference purposes.

It will, no doubt, be of use to French students who wish to get a general knowledge of the subject, but it could scarcely be recommended as other than a very elementary treatise. JAMES ROMANES.

Books Received.

AMERICAN PETROLEUM INSTITUTE. A.P.I. Specifications for :

BELTING. Supplement No. 1.
OIL-FIELD BOILERS. Supplement No. 2.
CABLE-DRILLING TOOLS. 8th Edn. 75 cents.
RIGS AND DERRICKS. 7th Edn. 65 cents.
PIPE (CASING, DRILL-PIPE AND TUBING). 9th Edn. 75 cents.
LINE PIPE. 6th Edn. 75 cents.
RIG IRONS. Supplement No. 1.
TRANSMISSION. Supplement No. 1.
ROTARY DRILLING TOOLS. Supplement No. 3.
WIRE ROPE. Supplement No. 1.
MANILLA CORDAGE. 5th Edn. 35 cents.
OIL WELL PUMPS. Supplement No. 5.
SUCKER RODS. 6th Edn. 50 cents.
INTERNAL COMBUSTION ENGINES AND CLUTCHES FOR OIL-FIELD SERVICE. Supplement No. 1.
MISCELLANEOUS PUMPING EQUIPMENT. Supplement No. 1.
STANDARD TANKS WITH RIVETED SHELLS. 5th Edn. 75 cents.
ALL-WELDED PRODUCTION TANKS. 1st Edn. 25 cents.

The above revised specifications and supplements incorporate the changes adopted at the Mid-year Meeting of the A.P.I. in May 1935. Copies can be obtained from the American Petroleum Institute, Division of Production, 1508 Gulf States Building, Dallas, Texas, at the prices stated.

ASLIB BOOK LIST. Quarterly. Association of Special Libraries and Information Bureaux, 16, Russell Square, London, W.C. 1. 10*s.* 6*d.* per annum.

The object of this quarterly list is to provide librarians with a selected list of recent scientific and technical books. Only books in the English language are included, and are listed under broad main subject headings. Under each heading they are further sub-divided into four classes : *A*, suitable for general readers; *B*, of an intermediate degree of technicality; *C*, of an advanced character; *D*, directories, etc.

INSTITUTION OF MECHANICAL ENGINEERS. Proceedings, Vol. 129. Jan.–March 1935. xi + 578 pp. 1935, Institution of Mechanical Engineers, London.

This volume includes the papers read before the Institution during the first three months of 1935. The proceedings of the Spring Meeting of the Internal Combustion Engine Group are reported and include two symposia, one on Supercharging and the other on the Gas Engine as a Competitor in the Power Field.

INTERNATIONAL REPERTORY OF CENTRES OF CHEMICAL DOCUMENTATION. 115 pp. 1935. Office International de Chimie, 28, Rue Saint-Dominique, Paris. (In English, French and German.)

Every year there are published more than two thousand volumes of interest for chemists. More than three thousand periodicals publish papers for their benefit. The task of documentation centres is to extract, for the benefit of investigators, all the useful material covered by this vast field of chemical literature. In 1932 the International Union of Chemistry entrusted to the International Office of Chemistry the work of preparing an International Repertory of existing centres of chemical documentation. The present publication is a directory of the principal centres in Europe and America, giving their addresses, the subjects in which they specialize, and a brief description of their mode of operation and resources.

U.S. BUREAU OF MINES :

INFORMATION CIRCULAR 6854. INDUCTION PROSPECTING FOR SHALLOW ORE DEPOSITS AND SMALL MAGNETIC OBJECTS. J. W. Joyce. 18 pp. Oct. 1935.

The principles underlying the operation of several electrical geophysical methods of locating small, buried, metallic objects are explained briefly and non-technically.

U.S. Bureau of Mines:

Monograph 6. Flow of Natural Gas Through High-Pressure Transmission Lines. T. W. Johnson and W. B. Berwald. iv + 120 pp. 1935, Superintendent of Documents, Washington, D.C.

In dealing with problems in the design and operation of gas lines the matter has been arranged to include, first, a listing of different pipe-line formulas, then a discussion of flow tests on commercial and experimental lines, followed by the application of flow data to commercial problems. The mathematical development of formulas is given in appendices.

Report of Investigations 3287. A Microcolorimetric Method for the Determination of Benzene. H. H. Schrenk, S. J. Pearce and W. P. Yant. 11 pp. Oct. 1935.

A colorimetric quantitative method for the determination of small amounts of benzene in vapour or liquid phase. As little as 0·001 mg. of benzene may be determined and the accuracy is 5 per cent. in the range of 0·01 to 0·06 mg. benzene.

Technical Paper 565. Reduction of Evaporation Losses from Gasoline Bulk-Storage Stations. L. Schmidt and C. J. Wilhelm. 35 pp. 1935, Superintendent of Documents, Washington, D.C. 5 cents.

Evaporation tests of several bulk-storage stations have been made under different operating conditions. This report gives the results of these tests and deals primarily with evaporation loss reduction in tanks of 10,000 to 12,000 gallons capacity.

U.S. Bureau of Standards:

Research Paper R.P. 825. Heats of Vaporization of Eight Gasolines. R. S. Jessop. 10 pp. 1935, Superintendent of Documents, Washington, D.C. 5 cents.

Data are presented on the heats of vaporization at 40° C. of fuels used in automobile and aircraft engines. The fuels examined were 1 natural gasoline, 2 aviation gasolines, 1 straight-run gasoline, 3 cracked gasolines and 1 hydrogenated safety fuel. The application of the results to ice formation in carburettors is discussed.

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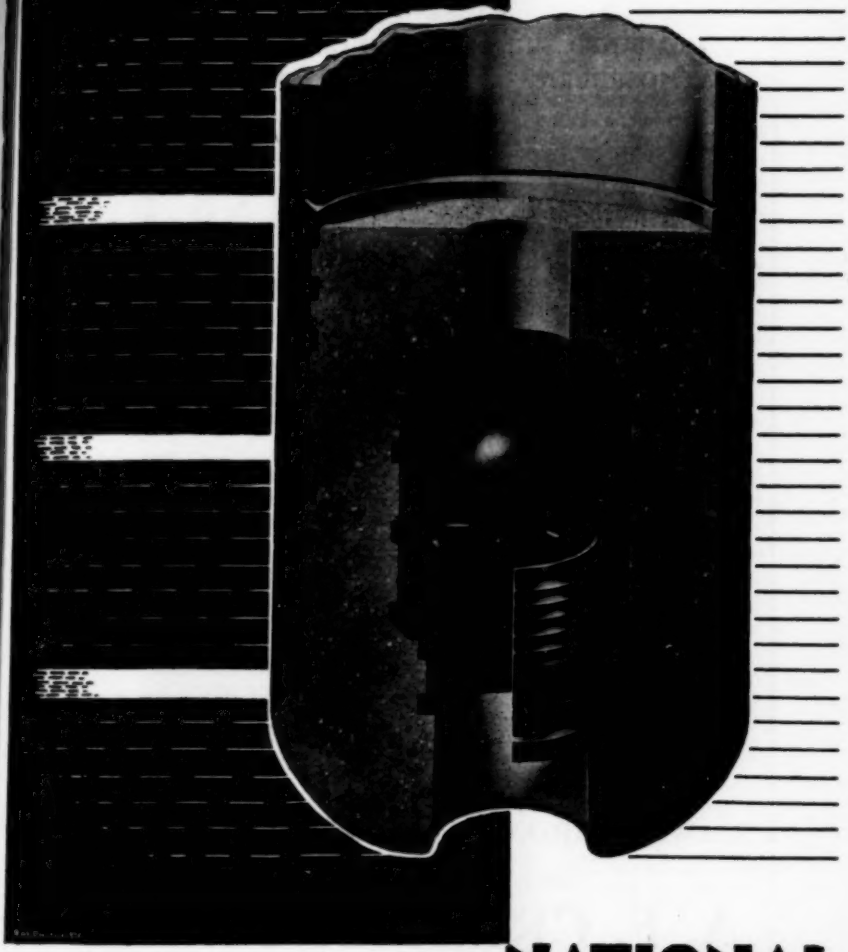

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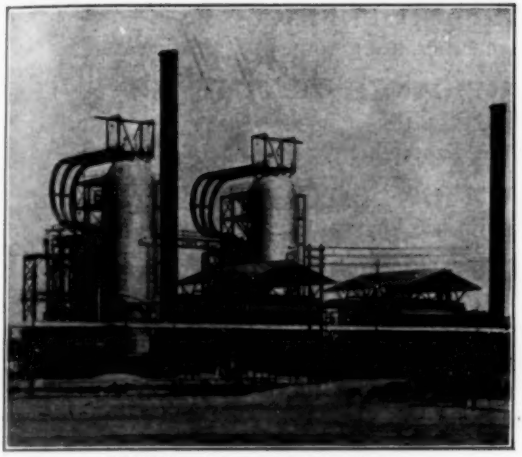

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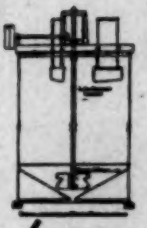

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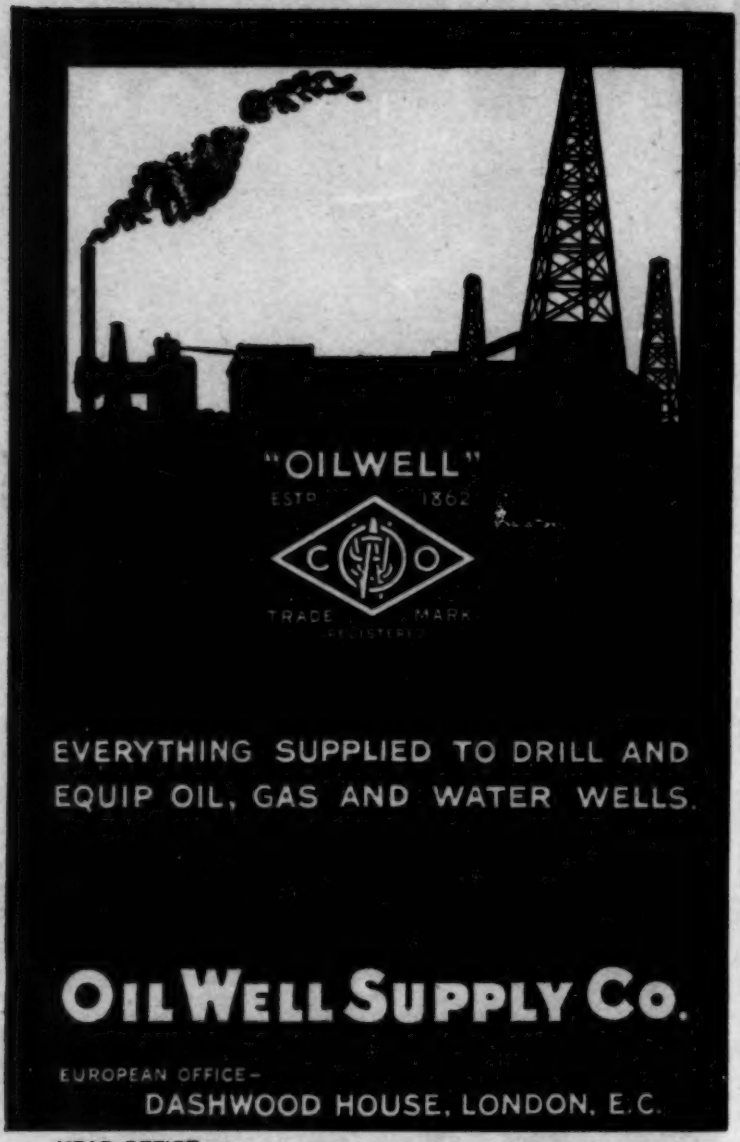

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